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COMPLÉMENT TECHNIQUE AU MÉMOIRE DU GRAND CONSEIL DES CRIS (DU QUÉBEC) ET DE L'ADMINISTRATION RÉGIONALE CRIE À LA COMMISSION DE L'ÉCONOMIE ET DU TRAVAIL DE L'ASSEMBLÉE NATIONALE DU QUÉBEC

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MÉMOIRE DU GRAND CONSEIL DES CRIS (DU QUÉBEC)
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INTRODUCTION

Le présent document est un complément technique annoncé dans le Mémoire du Grand Conseil des Cris (du Québec) déposé auprès de la Commission de l'économie et du travail de l'Assemblé nationale le 20 avril dernier.

Le mandat de la Commission parlementaire a été défini comme suit dans les avis publics de consultation générale:

- la place de l'électricité dans les besoins énergétiques du Québec;
- la situation et l'évolution de la demande d'électricité au Québec à moyen et à long terme;
- les orientations et les choix possibles afin de satisfaire l'évolution de la demande d'électricité au Québec à moyen et à long terme;
- les moyens, en termes de ressources et d'équipements, proposés par Hydro-Québec dans le cadre de son plan de développement pour réaliser son mandat et fournir l'électricité nécessaire au Québec;
- les moyens de concilier la satisfaction des besoins d'électricité au Québec, la qualité de l'environnement et le développement économique durable.

Ce mandat est vaste et les ressources limitées du Grand Conseil des Cris (du Québec)/Administration régionale crie ne permettent pas d'adresser au niveau technique l'ensemble de ces questions. Nous nous limiterons donc à un bref survol technique de certains des aspects de ce mandat afin d'éclairer les membres de la Commission parlementaire sur quelques sujets qui nous apparaissent les plus pertinents.

Notons d'ailleurs que les études techniques entreprises par le Grand Conseil des Cris (du Québec) sont sévèrement restreintes par l'absence d'information publique disponible. Signalons en particulier le refus d'Hydro-Québec de rendre disponible ses études de rentabilité à l'égard des contrats de vente d'énergie ferme et de capacité ferme aux États-Unis dans le cadre de sa politique d'exportation de 3 500 MW et le refus de cette société de rendre disponible le contenu de ses contrats conclus dans le cadre de son programme de partage de risques et de bénéfices dont, entre autres, les contrats relatifs aux nouvelles alumineries.

Il ne s'agit là que d'exemples parmi d'autres du secret qui entoure les informations d'Hydro-Québec en regard des aspects techniques du mandat de la Commission parlementaire.

Le Grand Conseil des Cris (du Québec)/Administration régionale crie dénonce ce contrôle de l'information qui rend difficile sinon impossible un véritable débat public quant aux enjeux du nouveau plan de développement d'Hydro-Québec.

Un tel véritable débat public ne pourra s'effectuer que lorsque la transparence d'Hydro-Québec sera rétablie.

À cet égard, nous réitérons ici qu'un débat public sur l'avenir énergétique du Québec et en particulier sur la proposition de plan de développement d'Hydro-Québec ne pourra s'effectuer que dans le cadre d'une commission d'enquête indépendante ayant un budget suffisant pour examiner toutes ces questions dans le cadre d'un débat public approfondi où l'information pertinente circulerait librement. Une telle commission d'enquête aurait pour mandat d'examiner ces questions pendant une période suffisante durant laquelle le Gouvernement du Québec imposerait un moratoire sur tout développement hydroélectrique dans le territoire de la Baie James, y compris à l'égard des infrastructures d'accès.

Le Grand Conseil des Cris (du Québec)/Administration régionale crie profite de cette occasion pour dénoncer avec force la prise de position du ministre au début des travaux de cette Commission parlementaire, déclarations qui préjudicient la crédibilité de ce forum et qui ne font que confirmer les craintes que nous exprimions dans notre Mémoire du 20 avril dernier.

Un débat public dans un forum indépendant s'impose d'autant plus que la crédibilité même d'Hydro-Québec est sérieusement remise en question. Il nous apparaît de plus en plus évident qu'Hydro-Québec, suivant les instructions du Gouvernement, a décidé de réaliser le projet Grande Baleine coûte que coûte et refuse d'effectuer des études ou de divulguer de l'information qui tendrait à nuire à la réalisation de ce projet.

À cet égard, nous référons les membres de la Commission parlementaire aux exposés techniques ci-dessous qui, malgré leurs

limitations évidentes, démontrent de façon éloquente que le développement des complexes NBR et Grande Baleine sont loin d'être requis pour le Québec.

Les études entreprises par Hydro-Québec ne font pas état des alternatives au développement hydroélectrique. Un tel comportement ne sied pas à une société d'état qui doit être au service de la population et qui devrait placer toutes les alternatives sur la place publique.

Cette propension d'Hydro-Québec à écarter toutes objections techniques au projet prend quelques fois des aspects draconiens et difficilement acceptables. À titre d'exemple, dans le plan de développement de l'an dernier d'Hydro-Québec on y avait annexé diverses cartes indiquant les grandes composantes environnementales du Québec dont la société d'état devait tenir compte dans ses plans de développement. La carte de l'an dernier pour l'ouest du Québec indiquait une vaste aire de vêlage du caribou autour du Lac Bienville et d'autres lacs et rivières qui seraient éventuellement affectés par le projet Grande Baleine. Or cette année, la nouvelle carte d'Hydro-Québec accompagnant la nouvelle proposition de plan de développement a été modifiée sans explication pour faire disparaître complètement cette composante environnementale. Il s'agit là de procédés pour dire le moins inusités qui suscitent chez nous de sérieuses interrogations quant à la crédibilité des informations divulguées par Hydro-Québec.

Dans le présent document nous nous proposons donc d'étayer aux membres de la Commission parlementaire les propositions suivantes:

a) La proposition de plan de développement d'Hydro-Québec et en particulier le souhait d'Hydro-Québec de développer les méga-projets de Grande Baleine et de NBR entraînerait des dépenses publiques énormes avec un accroissement proportionnel de la dette publique des Québécois. Ce plan de développement vise l'accroissement de la vente d'électricité par le biais du développement d'un marché à l'exportation d'énergie garantie vers les États-Unis et par le biais de subventions tarifaires aux industries grandes consommatrices d'électricité. Une telle stratégie risque d'encourir à brève échéance des accroissements substantiels de tarifs pour les consommateurs du Québec et risque également de distordre l'économie québécoise.

b) Il est possible de retarder la construction de nouvelles centrales électriques au moins jusqu'à l'an 2010 et même au-delà et ainsi éviter un endettement public important et des hausses substantielles de tarifs si les politiques suivantes étaient adoptées par Hydro-Québec.

   i) l'annulation des contrats d'exportation d'électricité conclus dans le cadre de la politique d'exportation de 3 500 MW et l'abandon de cette politique d'exportation;

   ii) l'abandon par Hydro-Québec de tout nouvel engagement en vertu de son programme de partage de risques et de bénéfices;

iii) l'application d'un programme restreint de gestion de la demande d'électricité ayant pour effet de réduire de 15% la demande projetée d'électricité d'ici l'an 2020. Un tel programme est facilement réalisable et serait plutôt restreint quand on compare avec les programmes de gestion de la demande appliqués ou proposés aux États-Unis.

Ces éléments d'une nouvelle politique énergétique du Québec n'entraîneraient aucun inconfort aux citoyens du Québec ni ne réduiraient leur niveau ou leur qualité de vie et n'affecteraient pas négativement la structure économique du Québec. Au contraire, ces trois éléments permettraient à Hydro-Québec et au Québec d'éviter un endettement massif, d'éviter un désastre écologique, d'éviter les pertes de profit appréhendées sur les contrats d'exportation, d'éviter les risques inhérents au programme de partage de risques et de bénéfices et d'accroître l'emploi au Québec puisque nos études démontrent que les programmes de gestion de la demande ont en général pour effet de générer plus d'emplois permanents que le développement de méga-projets hydroélectriques.

Les emplois générés par la gestion de la demande seraient des emplois dans la PME situés dans les régions plus habités du Québec et auraient des retombées économiques dans les secteurs de la fabrication, de la mise en marché, de la haute technologie et de la construction.

Nous examinerons tour à tour l'ensemble de ces questions.

I - UNE CRITIQUE SOMMAIRE DE LA PROPOSITION DE PLAN DE DÉVELOPPEMENT D'HYDRO-QUÉBEC

L'orientation fondamentale d'Hydro-Québec "consiste à fournir l'électricité au Québec aux meilleures conditions et à optimiser l'avantage comparatif que constitue l'hydroélectricité"[1].

Nos analyses tendent à démontrer qu'en suivant les politiques exposées dans sa proposition de Plan de développement, à savoir l'exportation d'électricité aux États-Unis, la vente à rabais d'électricité aux grands ensembles industriels et la construction de vastes méga-projets hydroélectriques pour satisfaire cette demande ainsi accrue, Hydro-Québec échoue dans son orientation fondamentale et expose les consommateurs et le Québec à des risques inacceptables.

Il est important d'ici noter que la décision d'Hydro-Québec de procéder à la construction des complexes Grande Baleine et NBR entraîne le Québec dans son entier dans une voie sans retour. Une fois que les investissements collectifs gigantesques auront été effectués, le Québec devra payer la note et rembourser ses emprunteurs. Hydro-Québec et le Québec devront donc trouver des débouchés pour l'énergie générée par ces barrages. La décision d'Hydro-Québec de procéder avec ces projets rendra presqu'impossible tout retour en arrière et rendra irréversible la dépendance du Québec envers une surconsommation outrancière d'électricité. Il y a donc lieu de procéder à une réflexion collective approfondie

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[1] Proposition de Plan de développement d'Hydro-Québec 1990-1992, Horizon 1999, à la page 1.

avant de se lancer dans une aventure hydroélectrique aux lendemains amers.

A. Les effets du plan de développement sur les tarifs et la dette publique

Déjà les tarifs d'Hydro-Québec augmenteront d'environ 20% au cours des trois prochaines années (7.5% en 1990, 7% en 1991 et une augmentation proposée de 6% en 1992).

Afin de payer les méga-projets décrits dans la proposition de plan de développement, il est à prévoir que les consommateurs québécois devront subir des hausses de tarifs supérieures à l'inflation pour au moins l'ensemble de la décennie. À cet égard, nos analyses préliminaires indiquent que les Québécois devront subir d'importantes hausses de tarifs afin de supporter les dépenses en immobilisations de $61.8 milliards proposées par Hydro-Québec.

D'ailleurs Hydro-Québec demeure mystérieusement silencieuse dans sa Proposition de Plan de développement à l'égard des effets de son programme d'investissements sur les tarifs. Pourtant quoique Hydro-Québec refuse de dévoiler ces effets dans sa proposition de plan, elle n'hésite pas à les dévoiler à ses financiers américains dans son plus récent prospectus américain daté du 3 avril 1990:

> "In the longer term, Hydro-Québec must maintain a strong financial condition while embarking on a program of major capital investments (see "Capital Investment Program"). For these reasons, Hydro-Québec expects to continue to

require rate increases in amounts that may exceed inflation." (page 10)

À cet égard, les études préliminaires faites à la demande du Grand Conseil des Cris (du Québec)/Administration régionale crie indiquent que les tarifs d'Hydro-Québec devraient, dans le scénario le plus optimiste, plus que doubler d'ici 1999 si le plan d'investissement proposé par Hydro-Québec était mis en vigueur. De plus, si des dépenses additionnelles étaient encourues par suite de dépassements de coûts de construction, de faible hydraulicité, de charges d'intérêts plus grandes que prévues ou par un taux de change défavorable, les tarifs d'Hydro-Québec pourraient s'accroître de 150% et même plus.

Hydro-Québec a sans doute procédé à diverses analyses de sensibilité à l'égard de l'effet sur ses tarifs de la mise en vigueur du plan d'investissement proposé. Ces analyses devraient être rendus publiques puisque c'est l'ensemble des citoyens du Québec qui assumeront la facture finale et il appartient à cette Commission parlementaire de s'assurer que ces informations soient disponibles vu les enjeux si importants pour le Québec.

Ce qui est particulièrement important de noter toutefois est l'effet du dépassement de coûts de construction des méga-projets sur les tarifs domestiques. En effet, compte tenu que les prix à l'exportation décroissent avec le temps et présumant que les prix industriels ne pourront s'accroître qu'au rythme de l'inflation afin d'assurer la compétitivité de l'industrie québécoise, des dépassements dans les coûts de réalisation des méga-

projets, même s'ils sont mineurs, auront des impacts substantiels à la hausse sur les tarifs domestiques.

À cet égard, il est important de noter que le coût du projet du Complexe La Grande (1975) a, selon les analyses utilisées, doublé sinon quadruplé par rapport aux estimations originales. Si une telle escalade des coûts de construction des complexes Grande Baleine et NBR devait se réaliser, l'impact sur les hausses de tarifs serait très important, particulièrement à l'égard des tarifs domestiques.

L'impact des investissements proposés d'Hydro-Québec sur sa dette serait également très important. Sur les $61.8 milliards prévus d'investissements, plus de $45 milliards seront consacrés pour la période 1990-1999 à la construction et à la réfection des équipements de production, de transport et de répartition.[2] En 1989, la dette d'Hydro-Québec garantie par le Gouvernement du Québec s'élevait à $22.4 milliards.[3] Cette dette s'ajoute à celle du Gouvernement du Québec au montant de $31.8 milliards.[4]

La réalisation du Plan de développement d'Hydro-Québec entraînera un accroissement spectaculaire de la dette garantie d'Hydro-Québec à au-delà de $60 milliards d'ici la fin de la

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[2] Source: Tableau 6.6 de la Proposition de Plan de développement d'Hydro-Québec 1990-1992, horizon 1999

[3] Source: Comptes publics du Gouvernement du Québec 1988-89 volume 1, page 3-82 et page 35.

[4] Source: Comptes publics du Gouvernement du Québec 1988-89 volume 1, page 16.

décennie. La dette d'Hydro-Québec dépassera alors largement celle du Gouvernement du Québec. La capacité d'emprunt des Québécois aura alors essentiellement servi à Hydro-Québec plutôt qu'aux autres projets collectifs pressants du Québec.

Il est d'ailleurs à craindre qu'un tel accroissement spectaculaire de la dette publique qu'assumeront les Québécois atteigne alors un niveau difficilement acceptable, particulièrement dans le contexte où la dette d'Hydro-Québec sera en large partie contractée auprès de créanciers étrangers (américains pour la plupart). Le tableau suivant place cette dette en perspective:

DETTE D'HYDRO-QUÉBEC

	1989	1999	Pourcentage d'accroissement
Dette totale	22.4 milliards	60 milliards[5]	168%
Population	6,899,000	7,173,000[6]	4%
Dette d'Hydro-Québec per capita	3,246	8,365	158%
Ménages	2,612,000	3,043,000[7]	16.5%
Dette d'Hydro-Québec par ménage	8,575	19,717	130%

[5] Estimation conservatrice

[6] Selon les estimations d'Hydro-Québec

[7] Selon les estimations d'Hydro-Québec

B. La "rentabilité" des exportations

L'essentiel de la hausse de la demande d'électricité projetée par Hydro-Québec provient de sa politique d'exportation d'électricité et de sa politique d'encouragement aux industries grandes consommatrices d'électricité dont nous traitons ci-dessous.

En effet, les prévisions de ventes à l'exportation d'Hydro-Québec indiquent que près de 12% des ventes totales d'Hydro-Québec en l'an 2006 proviendront des exportations.[8] Il s'agit là de chiffres minimums qui ne tiennent compte que de la politique actuelle d'Hydro-Québec d'exporter 3 500 MW, mais déjà l'entreprise donne des signes de vouloir exporter encore plus d'électricité aux États-Unis et parle même d'un potentiel de plus de 9 000 MW au-delà des engagements actuels.[9] Il s'agit là d'engagements très importants pour Hydro-Québec et le Québec. Nous nous proposons dans un premier temps d'examiner la rentabilité des exportations par la passé et dans un deuxième temps de procéder à une analyse sommaire de la rentabilité des contrats conclus à ce jour dans le cadre de la politique d'exportation de 3 500 MW.

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[8] Source: Proposition de Plan de développement 1990-1992, horizon 1999, tableau 3.13 à la page 69.

[9] Source: Proposition de Plan de développement 1990-1992, horizon 1999, pages 68 et 69.

a) Perspectives historiques: les exportations n'ont pas été profitables ou à tout le moins peu profitables au Québec.

Hydro-Québec se vante d'avoir tiré profit des exportations d'électricité par la passé et affirme sans analyse détaillée que des:

> "revenus de plus de 5 milliards de dollars réalisés entre 1980 et 1989 ont, d'une part, permis de maintenir les tarifs au Québec à un niveau au moins 10% inférieurs à ce qu'ils auraient été autrement, et d'autre part, ont contribué à financer les investissements requis pour la croissance et l'amélioration du réseau au Québec".[10]

Cette affirmation laisse croire que les exportations ont été profitables à Hydro-Québec et aux Québécois. Qu'en est-il vraiment.

De 1980 à 1989, Hydro-Québec a exporté approximativement 71 TW/hrs d'énergie régulière à l'exportation et 131 TW/hrs d'énergie excédentaire résultant en des revenus de $1.9 milliards et de $3.2 milliards respectivement. Sans examen plus approfondi l'on pourrait croire que les affirmations d'Hydro-Québec sont correctes. Cependant, une distinction doit être faite entre les exportations d'énergie régulière, qui sont des engagements à long terme de fournir l'électricité sur demande, et les exportations énergétiques excédentaires qui sont censées être des exportations

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[10] Source: Proposition de Plan de développement d'Hydro-Québec 1990-1992, horizon 1999, page 63.

d'énergie qui seraient autrement excédentaires aux besoins intérieurs du Québec.

Énergie régulière à l'exportation

Un contrat d'énergie régulière à l'exportation place une demande à long terme sur le réseau et doit être desservie comme tout autre client majeur d'Hydro-Québec. Le prix à l'exportation devrait normalement tenir compte d'une proportion équitable des coûts associés à la production et au transport de l'énergie. Si le prix unitaire à l'exportation est supérieur au coût marginal du réseau, il peut alors y avoir un bénéfice pour les autres usagers du réseau. À cet égard, examinons comment les revenus unitaires à l'exportation se comparent aux coûts unitaires du réseau et aux revenus unitaires moyens des ventes au Québec pour la même période.

N'ayant pas les coûts marginaux ni les coûts détaillés d'Hydro-Québec, la société d'état refusant de les fournir, nous ne pouvons travailler qu'avec la documentation disponible, soit les charges unitaires générales du réseau. Il s'agit là de données incomplètes mais qui nous permettent à tout le moins de dégager les grandes tendances financières de ces contrats.

Durant la période de 1985 à 1989, le revenu unitaire a été généralement inférieur au coût unitaire pour les ventes régulières à l'exportation.

	1985	1986	1987	1988	1989[11]	Pourcentage d'accroissement sur 5 ans
Produit unitaire de vente d'électricité régulière à l'exportation (cents le kilowattheure)	3.16	3.47	3.07	3.01	3.16	0%
Charge unitaire totale	3.18	3.06	2.98	3.20	3.63	14%
Différence	(.02)	.41	.09	(.19)	(.47)	

La comparaison des produits unitaires de ventes d'électricité au Québec avec les produits unitaires de vente d'électricité régulière à l'exportation indique également que ces dernières supportent moins leur fardeau des coûts:

	1985	1986	1987	1988	1989[12]	Pourcentage d'accroissement sur 5 ans
Produit unitaire de vente d'électricité régulière à l'exportation (cents le kilowattheure)	3.16	3.47	3.07	3.01	3.16	0%
Produit unitaire de vente régulière d'électricité au Québec	3.63	3.73	3.79	3.88	4.07	12%
Différence	(0.47)	0.26	(0.72)	(0.87)	(0.91)	

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[11] Source: Rapport annuel 1989 d'Hydro-Québec, page 67.

[12] Source: Rapport annuel 1989 d'Hydro-Québec, page 67.

En l'occurrence, dans le cas de l'exportation d'énergie régulière, quoique les revenus générés par ces exportations contribuent à la rentrée de fonds, ces revenus ne sont pas suffisants pour couvrir leur juste part des coûts associés à la production de cette électricité.

L'affirmation d'Hydro-Québec à l'effet que les ventes régulières à l'exportation sont bénéfiques aux Québécois n'est donc pas exacte en regard à tout le moins de la situation qui a prévalu au cours des cinq dernières années.

Énergie excédentaire à l'exportation

Hydro-Québec affirme à l'égard des exportations d'énergie excédentaire:

> "(qu'en) période de forte hydraulicité, plutôt que de déverser le surplus d'eau de ses réservoirs, Hydro-Québec peut l'offrir aux réseaux voisins sous forme d'énergie excédentaire et faire bénéficier sa clientèle des revenus qui en découlent. Bien que les prix soient alors inférieurs à ceux obtenus en vertu de ventes d'électricité garantie, cela produit quant même des entrées de fonds intéressantes pour l'entreprise."[13]

Pendant la période de 1980 à 1984, l'hydraulicité était forte ce qui a permis à Hydro-Québec de réaliser $1.6 milliard de

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[13] Proposition de Plan de développement d'Hydro-Québec 1990-1992, horizon 1999, page 66.

revenus par le biais de la vente d'électricité excédentaire. Ces ventes étaient bénéfiques à l'entreprise. Malheureusement Hydro-Québec est devenu financièrement dépendante sur ces revenus de vente d'électricité excédentaire et refusa de se passer de ces revenus dans les années subséquentes malgré que l'hydraulicité ne permettait plus de réaliser de telles ventes excédentaires à l'exportation. À compter de 1985, Hydro-Québec s'est permis d'emprunter sur ses réserves afin de vendre de l'énergie prétendument "excédentaire" mais qui n'en était pas. Les Québécois paient aujourd'hui le prix de cette incurie.

Hydro-Québec possède une énorme capacité de stockage dans ses réservoirs qui possèdent une capacité équivalente à 140 TW/hrs, soit plus de l'ensemble des ventes d'Hydro-Québec en 1989. Ces réservoirs permettent à Hydro-Québec de se prémunir contre une faible hydraulicité. Au cours des 46 dernières années, 24 d'entre-elles ou 52% ont été des années de faible hydraulicité.

La période de 1985 à 1989 a été caractérisée par une faible hydraulicité. Le volume des réservoirs est passé de 80% en 1985 à 41% à la fin de 1989 pour une réduction de réserve hydraulique équivalente à près de 55 TW/hrs. Par contre, durant cette même période Hydro-Québec exportait 66 TW/hrs d'électricité prétendument "excédentaire". Il n'y a aucun doute qu'Hydro-Québec a drainer ses réserves hydrauliques par ces ventes excédentaires effectuées à des prix de rabais et s'est ainsi placée dans une situation très précaire qui a eu et continuera d'avoir des effets négatifs importants sur sa situation financière et sur son habileté à répondre à la demande interne du Québec. Hydro-Québec a spéculé avec ses réserves d'eau et a drainé ses réservoirs aux fins

d'exporter dans l'espoir que l'hydraulicité reviendrait à la normale. La spéculation n'a pas réussi et les rapports de précipitation pour le premier quart de 1990 ne sont pas encourageants.

Comme conséquence directe de la réduction des réserves hydrauliques pour l'exportation et face à la faible hydraulicité, Hydro-Québec a dû prendre des mesures exceptionnelles, y compris la remise en service de la centrale thermique de Tracy, le rachat des contrats de bi-énergie et l'importation d'énergie.

Les coûts de ces mesures exceptionnelles ont atteint $252 millions en 1989 et pourront atteindre jusqu'à $835 millions d'ici la fin de 1990 si la faible hydraulicité perdure. Si la faible hydraulicité continue jusqu'en 1992, le coût total des mesures exceptionnelles pourrait atteindre $2.4 milliards.[14]

La principale raison des hausses de tarifs de 1990 et 1991 n'est pas attribuable à la faible hydraulicité, mais à la décision téméraire d'Hydro-Québec de vendre ses réserves à rabais à l'exportation par le biais de ventes d'énergie prétendument "excédentaire".

Il est encourageant de noter qu'Hydro-Québec n'entend pas continuer ses ventes d'énergie "excédentaires". Si cette politique de prudence avait été mise en vigueur il y a cinq ans, les réservoirs auraient été remplis à 92% de leur capacité à la fin de 1989 plutôt qu'à 41%. Le graphique ci-annexé est éloquent à cet égard.

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[14] Proposition de Plan de développement d'Hydro-Québec 1990-1992, horizon 1999, pages 116 et 117.

Les tableaux ci-annexés décrivent les impacts financiers négatifs des ventes "excédentaires" à l'exportation et démontrent que les ventes effectuées depuis 1985 n'ont pas été bénéfiques pour l'entreprise.

TABLEAU 1.1

L'IMPACT DE LA VENTE D'ELECTRICITE EXCEDENTAIRE EXCESSIVE A L'EXPORTATION SUR LES RESERVES ET LES FINANCES

Annee	Exportation "Excedentaire" en T Whrs	Produits des Ventes (Millions)	Revenu Unitaire c /KW hr	%age de Capacite des Reservoirs	Capacite *des* Reservoirs en T Whrs	Reserve Manquante suite a la vente Excessive en T Whrs	Revenu provenant des Reserves
1985	17.3	455	2.63	80 a 67	112 a 94	2.0 *	53
1986	20.0	407	2.04	67 a 71	94 a 100	2.0 *	40
1987	20.5	457	2.23	71 a 61	100 a 85	20.5	457
1988	7.7	195	2.53	61 a 50	85 a 70	7.7	195
1989	0.9	29	3.22	50 a 41	70 a 57	0.9	29
	66.4	1,543	2.32	-39%	-55 T Whrs	33.1	774

*Hydro-Quebec a le benefice de doute durant ses deux annees mais un argument peut etre soutenu qu'aucun excedent n'existe lorsque les reservoirs sont remplis a moins de 90 a 95% de leur capacite.

TABLEAU 1.2

CHARGE DES MOYENS EXCEPTIONNELS POUR PALLIER LA MANQUE D'EAU DANS LES RESERVOIRS

		T Whrs	Charge	Charge Unitaire
	1988	0.7	33	4.71
	1989	5.0	219	4.38
Si l'hydraulicite faible continue	*1990*	13.6	583	4.29
Si l'hydraulicite faible continue	*1991*	13.8	683	4.95
		33.1	1,518	4.59

TABLEAU 1.3

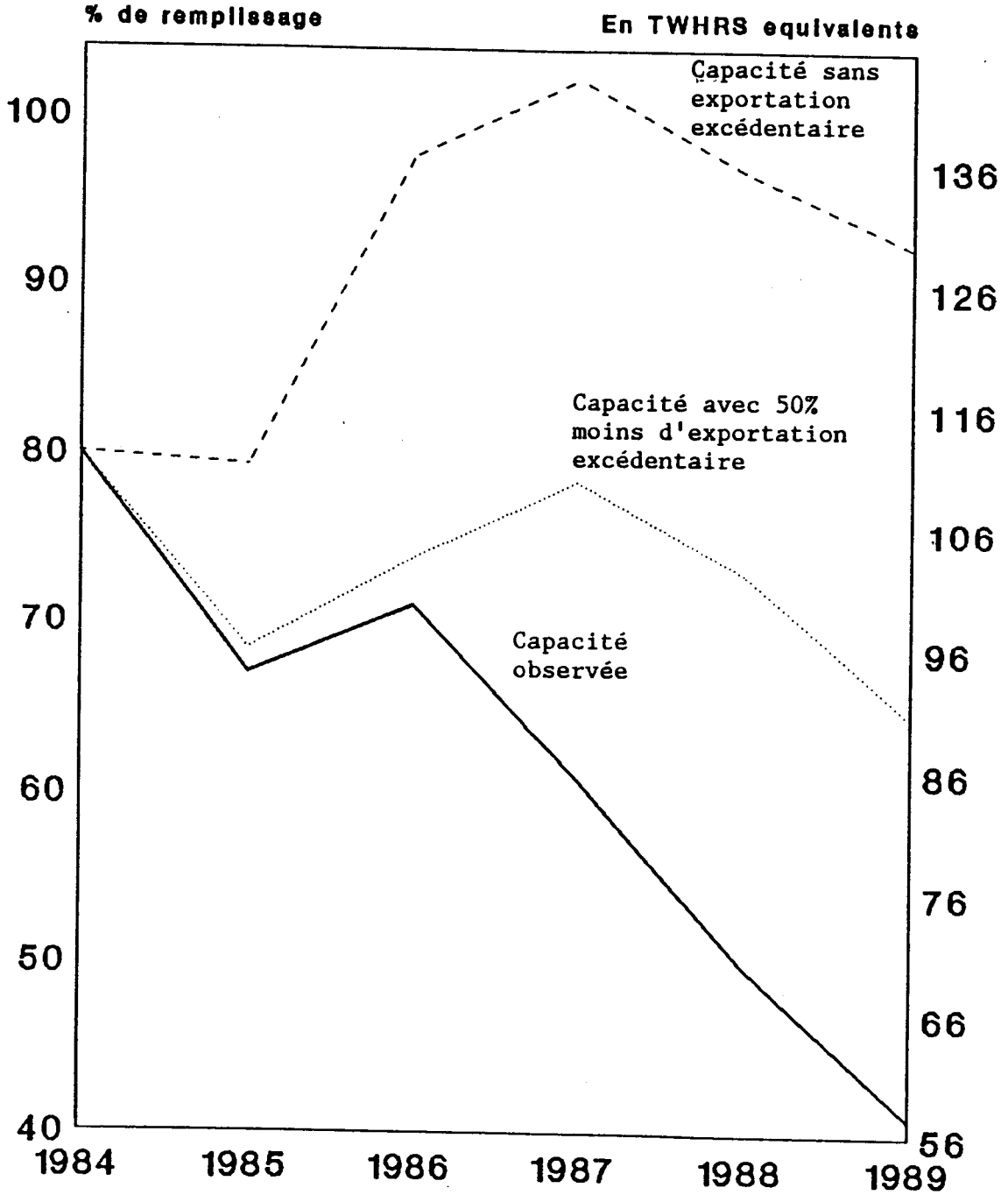
BENEFICE NET DE 1985 A 1989 NORMALISE POUR TENIR COMPTE DE LA VENTE DES RESERVES

(en millions de dollars)

	1989	1988	1987	1986	1985	Total
Benefice net declare	$565	619	508	303	209	2,204
Moins benefice net de la vente de la reserve a l'exportation	(29)	(195)	(457)	(40)	(53)	(774)
	536	424	51	263	156	1,430
Ajouter les charges des moyens exceptionnels	219	33	=	=	=	252
Benefice net normalise	$755	457	51	263	156	1,682
Surevaluation (Sous-evaluation) du benefice net	(25%)	35%	896%	15%	34%	31%
Marge beneficiaire declaree	10.2%	11.7%	10.0%	6.4%	4.7%	
Marge beneficiaire normalisee	13.7%	9.0%	1.1%	5.6%	3.5%	

Graphique 1.1

L'EFFET DE LA VENTE D'ELECTRICITE "EXCEDENTAIRE" A L'EXPORTATION SUR LA RESERVE ENERGETIQUE



Conclusion

Tel qu'il appert ci-dessus, un examen des cinq dernières années démontre que les exportations tant d'énergie garantie que d'énergie excédentaire n'ont pas bénéficié aux Québécois. Au contraire, les politiques d'Hydro-Québec à cet égard ont mis en péril les réserves hydrauliques et ont contribué en grande partie aux hausses de tarifs et aux difficultés financières de l'entreprise.

Vu l'absence de réactions du Gouvernement du Québec face à un tel gaspillage, l'on ne peut que conclure que celui-ci ignorait ce qui se passait ou approuvait cette spéculation d'Hydro-Québec avec les réserves énergétiques du Québec.

b) Les exportations en vertu de la politique des 3 500 MW

C'est en ces termes qu'Hydro-Québec justifie sa politique d'exportation de 3 500 MW:

> "À long terme, les exportations de puissance et d'énergie garanties seront très rentables et amèneront des retombées économiques importantes au Québec."[15]

Cependant, Hydro-Québec refuse de rendre publiques ses études de rentabilité à l'égard des deux seuls contrats d'exporta-

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[15] Proposition de Plan de développement d'Hydro-Québec 1990-1992, horizon 1999, page 64.

tion qui ont été soumis à ce jour à l'Office national de l'énergie, soit le contrat de 450 MW avec le Vermont et le contrat de 1 000 MW avec New York.

Hydro-Québec se cache derrière le "secret commercial" pour refuser de dévoiler ses études de rentabilité et ses coûts marginaux de production. Pourtant ailleurs en Amérique du Nord de telles informations ne sont pas gardées confidentielles par les producteurs d'électricité.

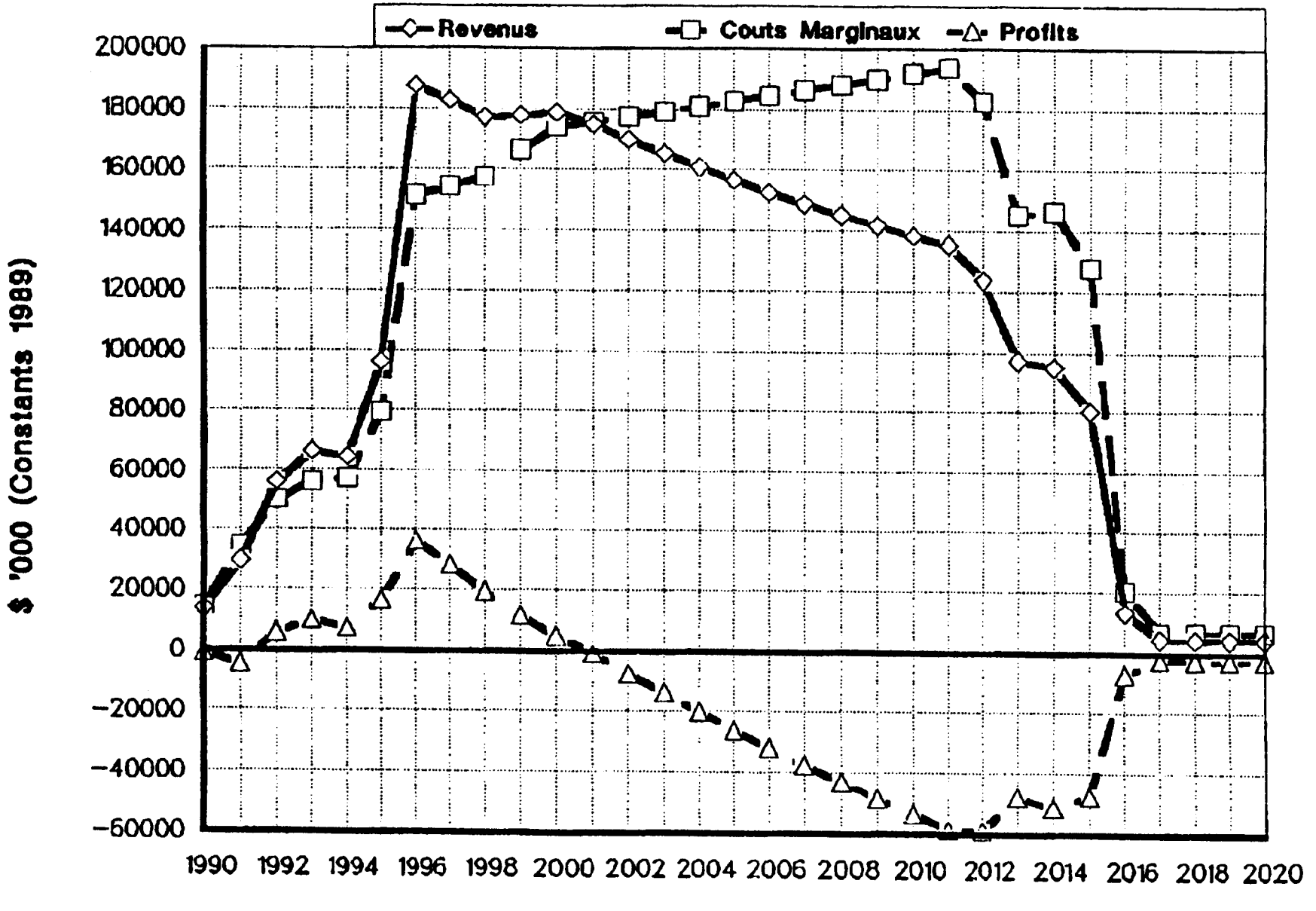
Cette absence de transparence nous permet de douter de la rentabilité de ces contrats d'exportation.

Les études effectuées à la demande du Grand Conseil des Cris (du Québec)/Administration régionale crie, faites à partir du peu de documentation disponible, tendent à démontrer que ces contrats ne sont pas rentables. L'Annexe C ci-annexée concernant les contrats avec le Vermont et New York respectivement démontrent avec éloquence qu'Hydro-Québec subira des pertes en regard de chacun de ces contrats. Les revenus projetés de ces contrats indiqués à l'Annexe C proviennent des chiffres fournis par Hydro-Québec à l'Office national de l'énergie et les coûts marginaux sont une estimation basée sur la meilleure information disponible.

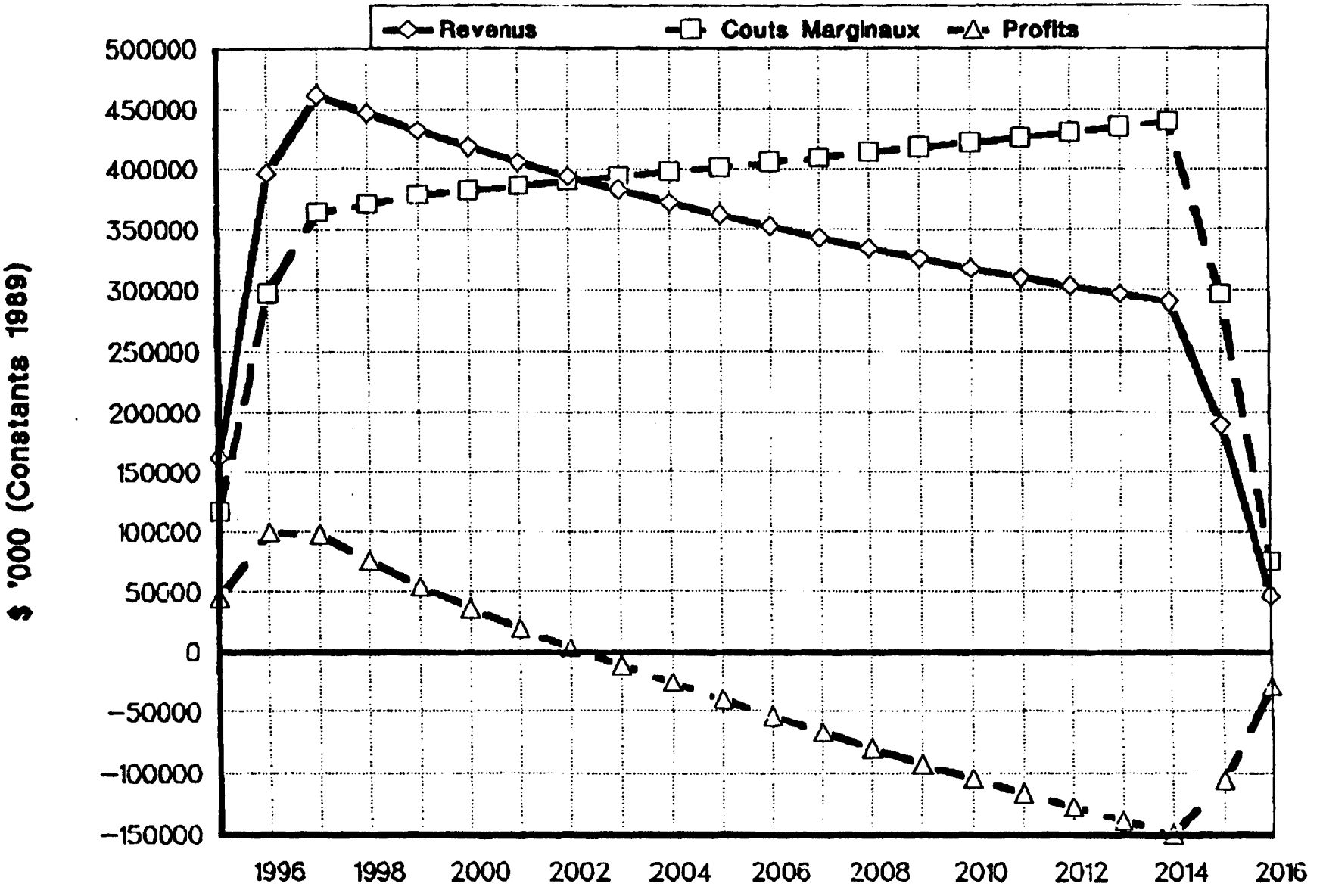
Ces tableaux ne tiennent d'ailleurs pas compte de l'effet de dépassements eventuels de coûts de construction pour Grande Baleine ou NBR, ni d'autres facteurs qui peuvent rendre ces contrats encore plus hasardeux.

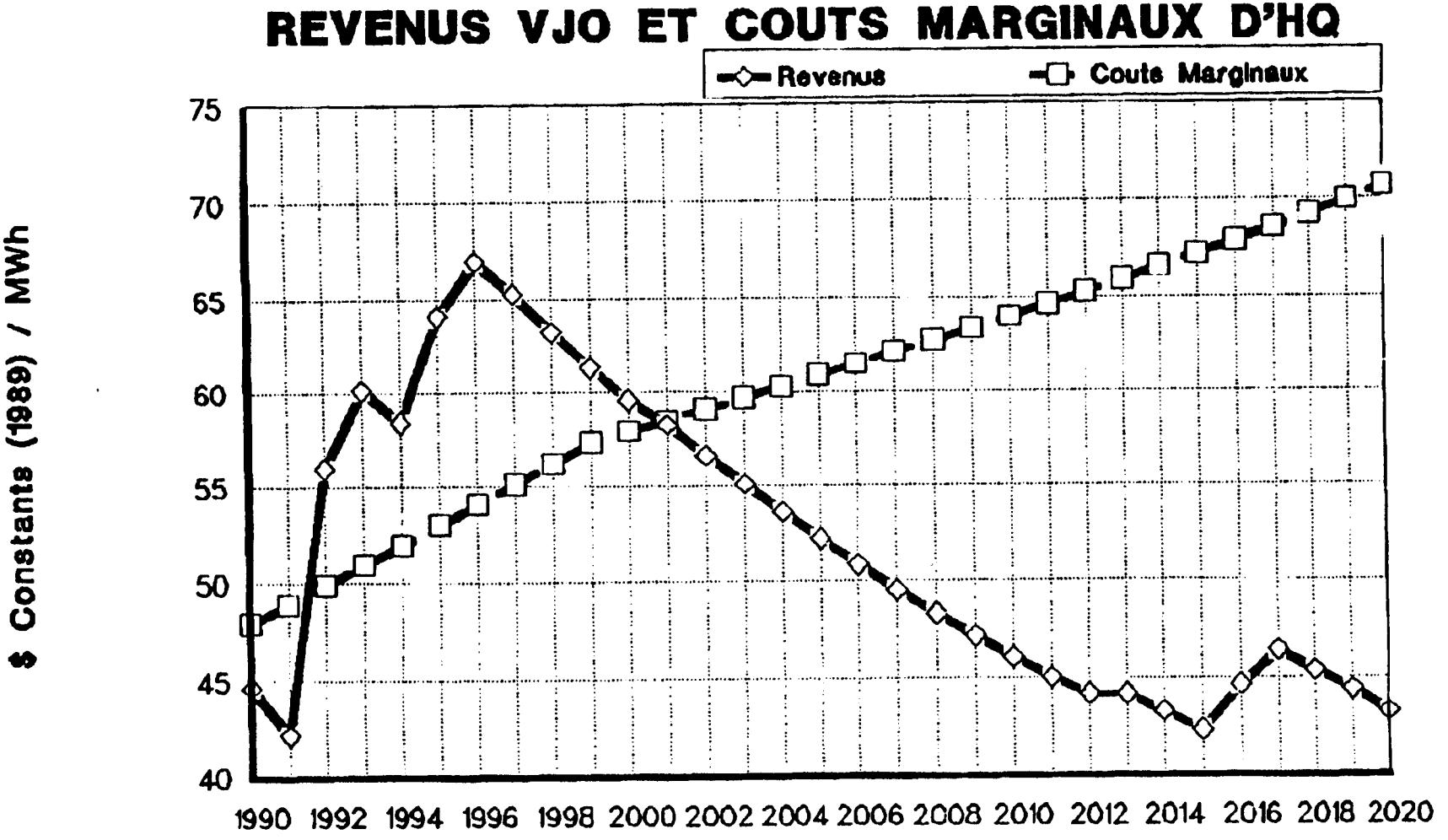
Nous vous référons également aux quatre graphiques ci-annexés qui présentent visuellement les revenus, coûts et profits d'Hydro-Québec pour les contrats avec le Vermont (VJO) et New York (NYPA) respectivement, de même que les revenus de ces contrats en comparaison des coûts marginaux présumés.

REVENUS, COUTS ET PROFITS DU CONTRAT VJO

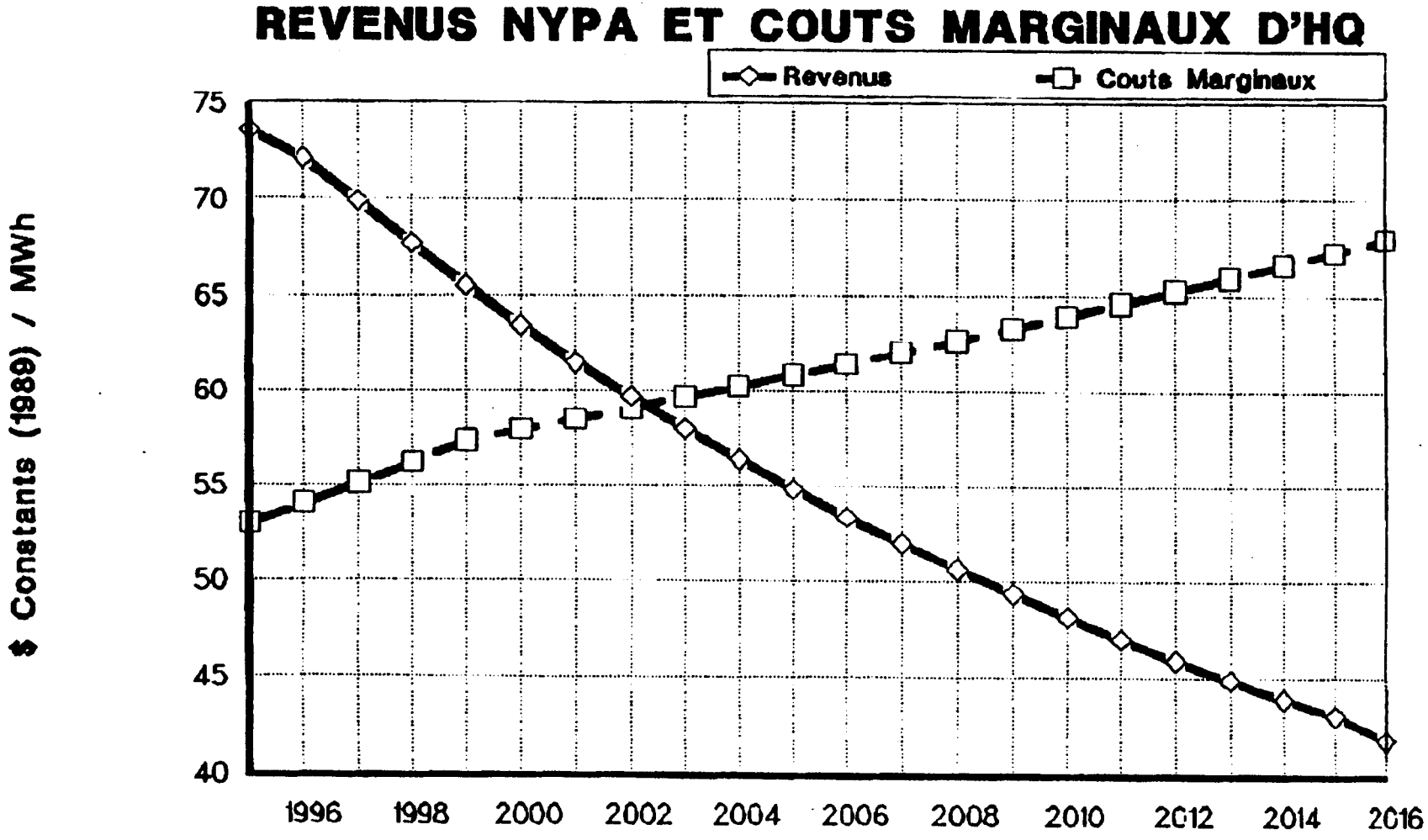


REVENUS, COUTS ET PROFITS DU CONTRAT NYPA




REVENUS VJO ET COUTS MARGINAUX D'HQ
Revenus
Couts Marginaux
$ Constants (1989) / MWh
75
70
65
60
55
50
45
40
1990 1992 1994 1996 1998 2000 2002 2004 2006 2008 2010 2012 2014 2016 2018 2020

REVENUS NYPA ET COUTS MARGINAUX D'HQ



L'on est donc loin des milliards de dollars de profits que fait miroiter Hydro-Québec dans les médias et il est grandement temps qu'Hydro-Québec justifie sa politique d'exportation en dévoilant ses études de rentabilité et en leur faisant subir une contre expertise publique et indépendante. Il est inacceptable que cette société d'état puisse engager les Québécois dans une aventure d'exportation des ressources naturelles du Québec de cette envergure sans débat public et sans dévoiler pleinement les conséquences financières de ses décisions.

Une multitude de raisons économiques, sociales, politiques, énergétiques et environnementales militent en faveur de l'annulation des contrats conclus en vertu de la politique d'exportation du 3 500 MW et l'abandon de cette politique. Le Grand Conseil des Cris (du Québec)/Administration régionale crie a fait longuement état de ces motifs devant l'Office national de l'énergie cet hiver et l'on réfère les membres de la Commission aux milliers de pages de documents et de témoignages rendus devant l'Office national de l'énergie à cet égard.

Ces contrats d'exportation ne servent qu'à justifier l'accélération des calendriers de construction des complexes Grande Baleine et NBR afin de placer l'ensemble du Québec devant un fait accompli à l'égard de ces projets.

Il est grandement temps que ces contrats soient annulés et la politique d'exportation de 3 500 MW mise au rancart.

Notons à cet égard que tous les contrats actuellement signés par Hydro-Québec dans le cadre de sa politique d'exportation

de 3 500 MW peuvent être annulés par le Gouvernement du Québec en vertu des termes contractuels mêmes de ces contrats et dans la plupart des cas sans pénalité pour Hydro-Québec. Une décision en ce sens devrait être prise dans les meilleurs délais.

C. Le programme de partage de risques et de bénéfices

Le programme de partage de risques et de bénéfices d'Hydro-Québec vise à attirer les industries fortes consommatrices d'électricité au Québec. Le principal volet de ce programme concerne l'installation de nouvelles alumineries au Québec.

Les contrats d'Hydro-Québec en vertu de ce programme sont gardés jalousement confidentiels par Hydro-Québec.

Malgré l'absence d'information, il apparaît très probable que ces contrats prévoient des tarifs d'électricité préférentiels pour les nouvelles alumineries, tarifs qui sont sans doute au-dessous des coûts de production d'Hydro-Québec. Cette société d'état espère sans doute récupérer ses pertes en vertu de ces bas tarifs par le biais de formules complexes de partage de bénéfices, mais puisqu'Hydro-Québec refuse de dévoiler le contenu de ces contrats, il est à craindre que ces formules de participation aux bénéfices ne se résument qu'à des subventions déguisées d'Hydro-Québec versées aux alumineries sur les instructions du Gouvernement et dont feront les frais tous les consommateurs d'électricité du Québec. Ces subventions déguisées sont sans doute interdites en vertu de l'Accord sur le libre échange et ceux du GATT et c'est sans doute la raison pour laquelle Hydro-Québec refuse de dévoiler le contenu des contrats.

D'ailleurs, Hydro-Québec elle-même reconnaît les risques inhérents à ces contrats et leur nature peu rentable pour l'entreprise:

> "(...) les contrats de partage de risques et de bénéfices avec les clients industriels forts consommateurs d'électricité peuvent dans une certaine mesure augmenter le risque d'affaire d'Hydro-Québec. Bien que l'entreprise entende récupérer les coûts de fourniture sur la durée de ces contrats, le concept de partage de risques propre à cette stratégie peut l'exposer à des baisses de revenus au cours de certaines années si la situation économique était défavorable (...)".[16]

L'effet du programme de partage de risques et de bénéfices d'Hydro-Québec est d'octroyer à un secteur particulier de l'économie (qui génère peu d'emplois et de retombées indirectes) des tarifs préférentiels pour la richesse naturelle que constitue l'électricité et ce aux frais de l'ensemble des consommateurs d'électricité du Québec.

Est-il en effet acceptable de demander à l'ensemble de l'industrie, des commerces et des consommateurs d'accepter des hausses de tarifs de 7.5% et 7.0% en 1990 et 1991 pour en partie combler le manque à gagner d'Hydro-Québec à l'égard des contrats d'aluminerie? Il s'agit là d'une distorsion des règles de

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[16] Proposition de Plan de développement d'Hydro-Québec 1990-1992, horizon 1999, page 123.

l'économie du Québec qui procure un avantage indu à un seul secteur économique. D'autant plus qu'une large partie des produits générés par ces contrats et en particulier l'aluminium sont voués à l'exportation en lingots, ce qui réduit d'autant les retombées économiques au Québec de ces industries.

Nous ne pouvons que conclure que ce programme d'Hydro-Québec ne vise qu'à gonfler artificiellement et à grands frais la demande d'électricité au Québec pour justifier la réalisation des méga-projets hydroélectriques dont le Gouvernement actuel et Hydro-Québec semblent déterminés à construire pour des motifs politiques plutôt qu'économiques.

D. Les risques

Tel que nous l'avons souligné ci-dessus, la Proposition de Plan de développement d'Hydro-Québec pose de sérieux problèmes à l'égard des hausses de tarifs, du niveau d'endettement public, de la rentabilité des exportations et de la rentabilité du programme de partage de risques et de bénéfices. Ces problèmes s'accroissent lorsque l'on tient compte de divers facteurs de risques tels que les dépassements imprévus des coûts de construction, la poursuite de la faible hydraulicité, les modifications imprévues au scénario de demande énergétique, etc.

Les conséquences de ces facteurs de risques sur les consommateurs québécois sont d'autant plus importantes que les contrats à l'exportation et les contrats conclus dans le cadre du programme de partage de risques et de bénéfices sont essentiellement à l'abri de toute hausse significative de tarifs. En bref,

il appartient aux consommateurs québécois d'assumer tous les coûts supplémentaires engendrés par ces risques.

Comme nous l'avons souligné, les dépassements des coûts de construction des méga-projets d'Hydro-Québec auront des effets significatifs sur les tarifs des consommateurs québécois et nous vous référons à nos remarques à cet égard ci-dessus.

Les coûts des méga-projets sont souvent sous-estimés et quelquefois les accroissements des coûts sont spectaculaires. L'exemple du Complexe La Grande (1975) est éloquent à cet égard. D'autres exemples abondent à travers l'Amérique du Nord qui démontrent qu'une estimation de coûts d'un méga-projet n'est souvent tout au plus qu'une approximation imprécise.

Dans la Proposition de Plan de développement d'Hydro-Québec, c'est le consommateur québécois qui défraiera la note de ces dépassements de coûts.

Tel que noté plus haut, le nord du Québec subit depuis cinq ans une sécheresse prolongée. Comme le signale Hydro-Québec elle-même, la santé financière de cette entreprise est très vulnérable aux situations de faible hydraulicité prolongée.

Il existe de grandes incertitudes à l'égard de l'hydraulicité. Il est possible que les changements climatiques planétaires que nous connaissons présentement modifient de façon substantielle les précipitations du nord du Québec. D'ailleurs la présente sécheresse est peut-être la conséquence de ces changements climatiques. Hydro-Québec reconnaît elle-même cette possibilité

et elle participe présentement à une étude internationale afin de déterminer si cette sécheresse nordique (qui d'ailleurs n'est pas limitée au Québec) ne serait pas l'une des conséquences de l'effet de serre. Dans son plus récent plan de développement, Manitoba Hydro indique qu'un scénario de changement de climat affectant ses opérations hydroélectriques était "reasonable and plausible".

Compte tenu de ces incertitudes climatiques, il serait prudent de retarder de plusieurs années l'engagement du Québec et d'Hydro-Québec à la réalisation de méga-projets hydroélectriques afin d'étudier et d'analyser de plus près la situation d'hydraulicité.

La proposition d'Hydro-Québec de construire d'autres méga-projets hydroélectriques et d'accroître la demande par les exportations et les contrats de partage de risques et de bénéfices rendra l'entreprise encore plus vulnérable à cet égard. Tous les enjeux énergétiques du Québec seront dans le même et seul panier, celui de l'hydroélectricité.

II - UNE ALTERNATIVE À LA PROPOSITION DE PLAN DE DÉVELOPPEMENT D'HYDRO-QUÉBEC

Il existe des alternatives à la proposition d'Hydro-Québec d'investir des milliards de deniers publics dans le développement de méga-projets hydroélectriques. Nous nous proposons d'en étudier une sans prétendre qu'il s'agit là de la meilleure alternative, mais simplement pour démontrer que des alternatives viables et rentables sont à la portée des Québécois.

Cette alternative repose sur les trois principales politiques suivantes:

1) l'annulation des contrats d'exportation d'électricité et l'abandon de la politique d'exportation de 3 500 MW;

2) l'abandon par Hydro-Québec de tout nouvel engagement en vertu de son programme de partage de risques et de bénéfices;

3) l'application d'un programme restreint de gestion de la demande d'électricité ayant pour effet de réduire de 15% d'ici l'an 2020 la demande d'électricité projetée par Hydro-Québec.

De telles politiques auraient pour effet de retarder la construction de nouvelles centrales électriques pour au moins les vingt (20) prochaines années.

a) L'annulation des contrats d'exportation et l'abandon de la politique d'exportation de 3 500 MW

L'annulation des contrats d'exportation et l'abandon de la politique d'exportation de 3 500 MW aurait à tout le moins comme effet de retarder l'échéancier de construction des projets de Grande Baleine et de NBR. Le temps ainsi gagné permettrait d'étudier en profondeur les impacts environnementaux de ces projets tout en procédant à une analyse publique approfondie et pondérée de l'avenir énergétique du Québec.

Dans l'alternative suggérée au Plan de développement, nous écartons les exportations compte tenu de leur douteuse rentabilité et de la flexibilité accrue accordée au réseau d'Hydro-Québec s'il n'est pas obligé d'exporter 12% de sa production.

b) L'abandon du programme de partage de risques et de bénéfices

Compte tenu des risques inhérents à ce programme et des distorsions économiques qu'il entraîne et dont nous avons fait état plus haut, l'alternative proposée écarte tout nouvel engagement en vertu de ce programme.

c) La gestion de la demande

Il s'agit là de l'un des volets-clés de toute nouvelle politique énergétique.

Des gains énergétiques représentant 15% de la demande projetée par Hydro-Québec sont réalisables et sans doute des gains

plus substantiels seraient possibles. Un tel programme de gestion de la demande est conservateur.

Le Natural Resources Defense Council s'est joint au Grand Conseil des Cris (du Québec)/Administration régionale crie afin d'inviter le Québec et Hydro-Québec à appliquer un programme sérieux de gestion de la demande. À cet égard, vous trouverez en Annexe B la soumission du Natural Resources Defense Council à la Commission parlementaire et qui fait état du potentiel de conservation d'énergie au Québec, des expériences vécues ailleurs à cet égard et qui critique le programme de conservation d'énergie proposé par Hydro-Québec dans son Plan de développement. Le Natural Resources Defense Council est un organisme américain regroupant plus de 130,000 membres et voué à protection de l'environnement. Cet organisme s'est doté d'une expertise mondialement reconnue à l'égard de programmes de gestion de la demande énergétique et a participé à plusieurs tels programmes aux États-Unis. Tel que le démontre le Natural Resources Defense Council, il existe des alternatives économiquement viables au développement de méga-projets dont les effets environnementaux sont dévastateurs.

Vous trouverez également sous l'Annexe A une étude effectuée à la demande du Grand Conseil des Cris (du Québec)/ Administration régionale crie auprès de messieurs Ian Goodman et William Marcus (des experts reconnus dans de domaine) concernant un tel programme de gestion de la demande et incorporant une nouvelle projection de la demande d'électricité au Québec qui démontre que les projets existants peuvent satisfaire la demande au moins jusqu'à l'an 2010. Nous signalons qu'après l'an 2010 il

y a de nombreuses options autres que de nouveaux méga-projets hydroélectriques.

Ces études démontrent clairement qu'il existe des alternatives valables à la proposition de Plan de développement d'Hydro-Québec, des alternatives qui sont écologiquement, socialement et économiquement saines.

Mai 1990

ANNEX A

ALTERNATIVES TO HYDRO-QUÉBEC PROPOSED DEVELOPMENT PLAN

Adjustments to Hydro-Québec Load Forecast and an Expanded Demand Side Management Program

Preliminary study sponsored by the
Grand Council of the Crees (of Quebec)/
Cree Regional Authority prepared by
Messrs. Ian Goodman and William Marcus
May 21, 1990

INTRODUCTION

The purpose of this preliminary study sponsored by the Grand Council of the Crees (of Québec) / Cree Regional Authority is to present to the Parliamentary Committee of Québec's National Assembly presently reviewing the Hydro-Québec proposed Development Plan a summary alternative to the proposed massive hydro-electric development projects contemplated by Hydro-Québec in the James Bay Area.

This preliminary study is based on the following assumptions which we believe are reasonable and achievable:

a) the cancellation of the proposed 3,500 MW export policy of Hydro-Québec;

b) the cancellation of the existing Hydro-Québec policy to subsidize electricity sales to new large industrial customers specifically aluminium smelters;

c) the implementation of an expanded but conservative demand side management program for Hydro-Québec scaled to deliver total savings in the year 2020 that are equivalent to 15% of Québec requirements.

We have also reviewed summarily Hydro-Québec's Load Forecast and have incorporated minor adjustments to this forecast in areas which we believe are questionable.

Much of the technical aspects of the feasible demand side management potential of Hydro-Québec was the subject of lengthy research and testimony by ourselves both before the Vermont Public Service Board in relation to the review by that Board of the proposed 450 MW export contract by Hydro-Québec to the Vermont Joint Owners and before the recent National Energy Board hearings pertaining to the proposed Hydro-Québec export contract of 1,000 MW to the New-York Power Authority and of 450 MW to the Vermont Joint Owners.

We have also reviewed the effect on employment in Québec of investments in hydro-electric mega projects as compared to conservation.

We conclude that with minor forecast adjustments, additional demand side management programs and no new exports, the need for any new supply is delayed at least until 2010. To the extent that any additional energy supply is required after 2010, a wide variety of alternatives will be available. It is likely that no additional large hydro would ever be needed.

We also conclude that the cost of generating employment through demand side management is substantially less than through hydro electric construction projects and that demand side management should generate more long term employment potential for Québec then a comparable program of hydro construction and electricity intensive industrial development.

We reiterate here that these studies are preliminary and we encourage Québec to pursue further large scale studies in these areas which we believe will demonstrate that the demand side management potential for Québec is much higher than estimated.

A. ADJUSTMENTS TO HQ QUEBEC LOAD FORECAST

Relative to last year's forecast, HQ's current demand forecast predicts an additional 6.1 TWh in Quebec firm sales in 2000 and 4.0 TWh in 2006. See Figure 1.2. The increase in forecasted requirements since last year is roughly equivalent to the increase in projected consumption due to signing of new contracts with aluminum and magnesium smelters.[1] However since last year, HQ has also introduced plans for energy conservation programs that are projected to save 9 TWh in 1999 and 12.8 TWh in 2006. If the new smelter contracts and energy conservation programs were the only changes made since last year, the net effect would have been a reduction in this year's forecast of Quebec sales.

However, in 1990, HQ made several other major changes which substantially increase forecasted sales. For example, in the residential sector, estimates of average use by household appliances were increased by 13%. The overall effect of these changes is significantly greater than the new smelter contracts. See Figure 1.3. Viewed another way, the increases net of the smelter contracts have the effect of cancelling out the decreases due to energy conservation programs.

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[1] The increase in the 1990 forecast (relative to the 1989 forecast) due to the aluminum and magnesium smelters ranges from 3.5 to 7.7 TWh in the 1992-1997 period, and is 6.7 TWh from 1998 onward.

The 1990 HQ Forecast of residential sales incorporates several major changes relative to the 1989 Forecast. These changes have the effect of increasing forecast residential sales in 2006 by 4.8 TWh (prior to the effect of energy conservation programs). Approximately 2.0 TWh of this increase relates to an upward revision in the number of households.

HQ has also revised its estimates of average consumption per end-use. In the 1989 Forecast, HQ projected that efficiency improvements would significantly reduce average usage by appliances and space heating (in both new and existing housing). HQ now projects that average appliance usage will increase by 4% annually; the projected improvement in efficiency of 9% will be more than offset by increasing appliance use and introduction of new (unspecified) devices to the market. HQ does forecast some decline in average use for space heating, but the decrease is smaller than that forecast in 1989.

We believe that HQ's revision of average usage estimates is questionable. We have therefore adjusted HQ's estimates so that appliance and heating usage grow only as rapidly as the number of households. The net effect of these adjustments is to reduce HQ

residential sales in 2006 by 1.7 TWh.[2]

The HQ industrial demand forecast includes 2.8 TWh for "other large-power consumers" from 1999 onwards.[3] No detail is provided concerning what these industries will be, how likely they are to locate in Quebec, and their anticipated costs and benefits for the province. Furthermore, this projected load was not included in last year's forecast. HQ apparently has not yet made any commitments to serve this load, and its location in Quebec may require subsidies such as those provided the aluminum smelters. Given the absence of any description of what this load might be and its advantages for Quebec, we have adjusted the forecast to remove this "phantom" industry.

The adjustments we have made to HQ's 1990 demand forecast are intended to be conservative. Many of the assumptions used in the 1990 forecast appear to be questionable. However, it is difficult to determine how the forecast should be adjusted, since the published documentation of HQ forecast is so limited and some major increases in demand are completely unexplained. It is clear that

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[2] We have also adjusted HQ's estimate of water heating usage to more fully account for the effect of decreasing household size. In the Testimony of Marcus and Goodman before the NEB, we noted that HQ's 1989 estimate of water heating usage failed to properly account for this effect. HQ's 1990 estimate incorporates some, but not all, of our suggested adjustment.

[3] Electricity Demand in Quebec at page A4.3-A4.4.

a detailed, independent review of HQ's load forecasting is necessary. Otherwise, Quebec may invest billions of dollars for new hydro projects to meet inflated forecasts of Quebec requirements.

It is useful to compare how HQ demand forecasts have changed over time. As Figure 1.1 indicates, HQ's forecast of future Quebec priority requirements declined dramatically from 1981 to 1984, a period that coincides with the completion of the La Grande Phase I project. Since 1984, forecasts of Quebec load have generally increased. However, the increases are much more pronounced for projected demand through 1996. The projections for 2001 have not changed as much, and projections for 2006 have been relatively constant at around 197-201 TWh.

It is interesting to note that the load levels projected for 2006 coincide with a need for new power supply beyond that of La Grande Phase II. It is also quite interesting to note that HQ did not introduce substantial energy conservation programs until 1990; the net effect of the programs currently proposed and the other adjustments which HQ has made is to keep projected requirements for 2006 at the level that appears to require construction of Grande Baleine. The question arises: does HQ base its construction schedule for new dams on its demand forecast, or does HQ base its demand forecast on its construction schedule for new dams?

B. HYDRO-QUÉBEC'S PROPOSED PROGRAM

The significance of the DSM program proposed by HQ is uncertain. The proposed program could initiate a substantial commitment toward energy efficiency, which would have enormous benefits for Quebec. However, the depth of HQ's commitment and ability to carry out major conservation programs is not yet clear. The level of detail concerning the proposed program is very limited, and we are concerned that limitations in the design and management of HQ's programs could prevent them from fully tapping the available conservation potential. Furthermore, HQ's commitment in terms of funding levels is relatively small. Over the next ten years, HQ proposes to spend over $40 billion on new generation projects and less than $2 billion on energy efficiency,

HQ's proposed DSM program is based on relatively conservative assumptions about the potential of DSM. Projected savings in 2006 are less than 7% of load. An analysis of HQ conservation potential prepared by the Grand Council for the NEB hearing which is attached hereto indicated that conservation programs could achieve a 15% reduction in Quebec load by the year 2001.[2]

Analyses for many other utilities across Canada and the US

[2]In comparing estimates of conservation potential, it is important to differentiate between conservation that will occur due to price increases (natural efficiency) and that which requires specific conservation programs (program induced efficiency). The estimates prepared by Marcus and Goodman relate only to program-induced efficiency, so they should be compared with HQ's estimates of program effects.

have indicated substantially greater potential. In its Memoire, HQ argues that conservation potential in Quebec is lower than elsewhere, since supply costs are relatively low. HQ also attempts to show that Quebec energy use is similar to that of other geographic regions. The comparison of estimates of energy usage and conservation potential between different utilities and geographical areas is a complex and potentially misleading undertaking. For example, HQ states in its Memoire (page 12) that avoided costs in Ontario are 25% greater than in Quebec. Meanwhile, Ontario Hydro has stated that its supply costs from nuclear stations are as low, if not lower, than Hydro-Quebec's cost from new hydro projects.

Interpretation of the Graphiques in the Memoire comparing energy use in various regions is also problematical. A very different impression could be created by comparing Quebec with Japan and the nations of the EEC. As Figure 1.5 shows, most other industrialized nation have far lower net energy requirements per capita. The comparisons are also potentially misleading because of the manner in which electricity consumption is valued relative to fossil fuels. Figure 1.6 provides a comparison of gross energy requirements per capita for the same regions portrayed in Figure 1.5. In this case, Quebec energy usage is higher than that of all other regions, except for Canada.[3]

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[3]It should be noted that Figure 1.6 is based on the OECD method for valuing total energy requirements. This method is utilized by the Quebec Ministry of Energy Resources in Energy in Quebec, e.g., when calculating the degree of energy self-sufficiency for Quebec and other regions.

However, it is important to not get bogged down in technical debate, and thus lose sight of the larger goal. It is clear that the potential for electricity conservation is large throughout North America. It is also clear that conservation is relatively inexpensive compared to cost of new supply. The issue of whether potential is 15% or 50% is less important, especially in the short- and mid-term, than the question of how much of this potential will be achieved.[4]

The experience across North America indicates that the most important determinant of the amount of conservation achieved are the policies and commitment of the utilities and government agencies involved. As discussed in the attached Submission by the Natural Resources Defense Council, conservation has proven to be a highly reliable resource for the utilities that have chosen to rely heavily upon it. Utilities in California, the Pacific Northwest, and New England have achieved, and are planning to achieve, levels of electricity savings that are substantially greater than those planned by HQ.

For example, existing utility and governmental programs in California will have saved over 15% of electricity use by 1992.[5]

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[4]These points are made very strongly in Geller and Nadel, "Electricity Conservation: Potential Vs. Achievement," Paper prepared for NARUC Least Cost Utility Planning Conference, Charleston, SC, September 11-13, 1989; American Council for an Energy-Efficient Economy, Washington, D.C.

[5]California Energy Commission, Conservation Report, P400-88-004, October 1988 estimates 1992 savings as 15% relative to 1977 trends. Since the publication of this report, the California utilities have proposed a substantial expansion of their conservation programs, so savings will be higher than estimated in

The Vermont Public Service Board recently concluded that 10% clearly represents a lower bound for the amount of savings to be achieved by DSM programs by the year 2000; the Board indicated that the Vermont utilities can and should achieve significantly more. Vermont Public Service, Decision in Docket 5270, April 16, 1990. The Bonneville Power Administration (BPA) in the Pacific Northwest region has tested its ability to achieve a high proportion of conservation potential; BPA now generally assumes that it can achieve 85% of estimated cost-effective potential.

A major barrier to a more extensive conservation effort by HQ relates to the <<no-loser's test>> (also known as the <<non-participant's test>>) that HQ has adopted for screening the programs that it will be involved in. See HQ Memoire at 13-15. This criteria has the effect of dramatically restricting the amount of money a utility will invest in conservation and, thus, the conservation potential that can be achieved by utilities. As discussed in the attached Submission by the Natural Resources Defense Council, use of the <<no-loser's test>> has been rejected in jurisdictions throughout North America.

The effect of this criterion on HQ's conservation program is indicated by comparing the savings that HQ estimates for the average demand and high demand scenarios. In the high demand scenario where HQ would be willing to pay more for conservation, the savings in 2001 increase from 10.3 TWh to 18.1 TWh.

It is critical to note that HQ is not consistent in its use

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the Conservation Report.

of the <<no-loser's test>>. HQ uses this criterion only to limit incentives for conservation but does not apply it to the hundreds of millions of dollars in grants, loans, and below-cost rate contracts for aluminum smelters and other industrial electrotechnologies. Nor did HQ apply the <<no-loser's test>> to the subsidies which it used to promote the use of electric heat during the 1980's.

Our financial analysis indicates that HQ's aluminum smelter contracts result in substantial rate increases for Quebec residential and commercial ratepayers, and would never pass the <<no-loser's>> criterion applied to conservation. New hydro dams and transmission lines are more expensive than existing industrial rates (even without HQ's grants, loans, and other discounts); thus, new industrial load inevitably increases rates for other Quebec ratepayers. Nevertheless, HQ has to this date shown no concern that its incentives to industry should be limited because of their effect on the rates for other Quebec customers.

Another issue that should be raised in this context concerns HQ's refusal to publicly provide its cost estimates for new hydro projects and other data that is required to calculate the utility's marginal cost. The valuation of energy savings from DSM programs and energy purchases from independent producers is a function of the utility's marginal costs,[6] and this valuation influences the level of conservation expenditures that will be cost effective.

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[6]The marginal cost that will not be incurred if utility load is reduced is also known as the avoided cost.

If HQ persists in its policy of secrecy, it will be difficult, if not impossible, for independent experts to review the utility's conservation programs and provide input on how they might be improved. HQ's policy of secrecy is inconsistent with effective development of the Quebec's potential for conservation and independent power production.

C. AN EXPANDED DEMAND SIDE MANAGEMENT

As Quebec attempts to determine its long-term energy future, the potential contribution of energy efficiency programs is an issue of paramount importance. Conservation is likely to be the leading alternative to additional large hydro construction. However, the effect of conservation on HQ's supply plans will depend on the portion of total potential that can be achieved and the rate at which this potential is achieved.

To assess this issue, we have prepared Figure 1.7 and Table 1, which analyze total HQ energy requirements under three scenarios. The first scenario is the 1990 HQ Development Plan with a full export program.[7] In this scenario, total requirements increase by about 50% over the next 25 years and then decrease by 10 TWh over the following ten years as the export contracts phase out. The second scenario examines the effect of a moratorium on all new export contracts, including the VJO and NYPA Contracts already signed but not yet approved. In this scenario, growth in energy requirements over the next 15 years is not nearly as rapid.

The third scenario combines the effect of a moratorium on exports with reductions in Quebec requirements. These reductions consist of the adjustments to the residential and industrial forecast described above, and an expanded DSM program. This

[7]The 1990 Development Plan generally includes data only through the year 2006. Data for the period after 2006 is taken from HQ's Memoire.

expanded DSM program begins after 2001, when HQ's proposed program is winding down. The program was scaled to deliver total savings in the year 2020 that are equivalent to 15% of Quebec requirements.[8] The effect of this third scenario is that energy requirements grow by only 25% over the next thirty years, reaching 200 TWh in the year 2020.

The existing HQ power supply, together with the La Grande Phase II projects already under construction (La Grande 1, Brisay, La Forge 1) are capable of producing 190.7 TWh, assuming average run-off. Thus, the date at which energy requirements equal this level indicates when additional supply (or demand reduction) are likely to be required. In the HQ 1990 Development Plan scenario this occurs around 1996. With no new exports, new supply is needed around 1999. With no new exports, forecast adjustments, and additional DSM programs, the need for any new supply is delayed until 2010. The amount of new supply that is required is indicated in Table 1 under the category "Additional Measures;" it reaches 9 TWh in the year 2020.

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[8]The additional DSM, plus the total savings from HQ's proposed DSM program (12.8 TWH), equal 15% of Quebec load (prior to DSM and after forecast adjustments) in the year 2020. An analysis of HQ conservation potential prepared by the Grand Council for the NEB hearing (this analysis appears as Appendix B of the attached Joint Testimony of Marcus and Goodman) indicated that conservation programs could achieve a 15% reduction in Quebec load by the year 2001. A much more rapid phase-in of DSM is feasible, but we have not modeled such a phase-in; at the load levels forecast in our Scenario 3, a more rapid phase-in of DSM is not necessary.

The requirements for additional measures indicated in Table 1 may be overstated. First, it should be noted that HQ's Forecast, even as adjusted above, may be substantially too high. Second, achievable DSM potential over a thirty year period may prove to be substantially greater than 15%. Conservation technology is rapidly evolving, as is experience with managing conserving programs. As a result, the cost of conservation is dropping and the potential is increasing. See NRDC Submission and e.g. Northwest Power Planning Council, Conservation Supply for the 1990 Power Plan, Staff Issue Paper 89-47, November 1, 1989. Third, increases in the cost of electricity, as well as changes in Quebec policies concerning rates and energy supply, may result in substantial fuel switching of heating loads from electricity to lower cost alternatives such as natural gas.[9] Fourth, Quebec may modify its policies that encourage the location of electricity-intensive industry in the province, such that electricity requirements will be less than currently expected.

To the extent that any additional energy supply is required, a wide variety of alternatives will be available. It is important to remember that additional supply, above that already under

[9]This phenomenon, if unforeseen and unplanned for, can feed upon itself. As rates increase, load is lost; as load is lost, rates increase because fixed costs are spread over less sales; this increase in rates results in further loss of sales; and so on. HQ is more vulnerable to this phenomenon than other utilities, since it has a large portion of sales in markets that compete with other energy sources.

construction, will not be needed until 2010, twenty years from today. Furthermore, the requirements for any additional supply after 2020 are likely to be modest, since load growth is projected to be very low in the post 2015 period. The long lead-time affords Quebec ample opportunity to develop the least-cost, most environmentally benign sources. These sources might include repowering of existing hydro dams to increase output, small-scale hydro, cogeneration, biomass, photovoltaics, and other renewable sources and independent power production. See NRDC Submission and attached Joint Testimony of Marcus and Goodman at 27-30.

As was the case with DSM, the economical potential of these sources is likely to grow over time as technology improves and markets mature. Even at this time, the potential may be substantially greater than that estimated by HQ. For example, HQ envisions only 390 MW of independent power production by 1996 (Memoire at 15). However, the submission of Cascades, Inc. to this Commission indicates a potential <u>at this single company</u> of well over 50 MW from small hydro, cogeneration, and biomass.

Quebec could also consider the option of additional large-scale hydro development if such projects are determined to be economically and environmentally attractive. In particular, HQ could secure 4.4 TWh by constructing La Forge 2 and Eastmain 1 should it obtain appropriate authorizations for these projects.

In summary, it is clear that Quebec has alternatives to the scenario proposed in HQ's Development Plan and that these alternatives are far more attractive in terms of their economic, environmental, risk, and planning attributes. The scenario we have outlined with a moratorium on exports and expanded emphasis on DSM defers the need for any new hydro capacity not yet under construction for at least twenty years. It is likely that no additional large hydro would ever be needed. With a smaller investment program, a larger contribution of cost-effective DSM, and no more unprofitable exports and aluminum smelters, electricity bills for HQ's Quebec customers would be lower. Quebec would also benefit in terms of jobs creation. As the attached summary "Investments in Hydroelectricity and Conservation: the Effect on Employment" indicates, DSM will create more jobs than a comparable program of hydro construction and electricity-intensive industrial development. Moreover, the jobs created will be in Southern Quebec rather than in remote locations in the north.

Furthermore, our alternative strategy would decrease HQ's vulnerability to drought. HQ hydro reserves are currently very depleted. Even if HQ receives average run-off in all future years, the reservoirs will not completely refill during the next ten years. Figure 1.8 charts projects hydro reserves for the 1990

Development Plan and our no-export/additional DSM scenario.[10] From the mid-1990's onward, reservoir levels in our alternative scenario are substantially higher than those under the Development Plan scenario. These higher levels of reserves will assist HQ in dealing with any situations of below-average run-off. Our alternative scenario also avoids massive commitments to additional hydro construction. The economics and design of these new projects may be adversely affected if global climate change results in long-term modification of run-off patterns.

[10]Detailed reservoir level data for the Development Plan scenario is only available until the year 2000.

FIGURE 1.1: HQ FORECASTS OF QUEBEC PRIORITY REQUIREMENTS

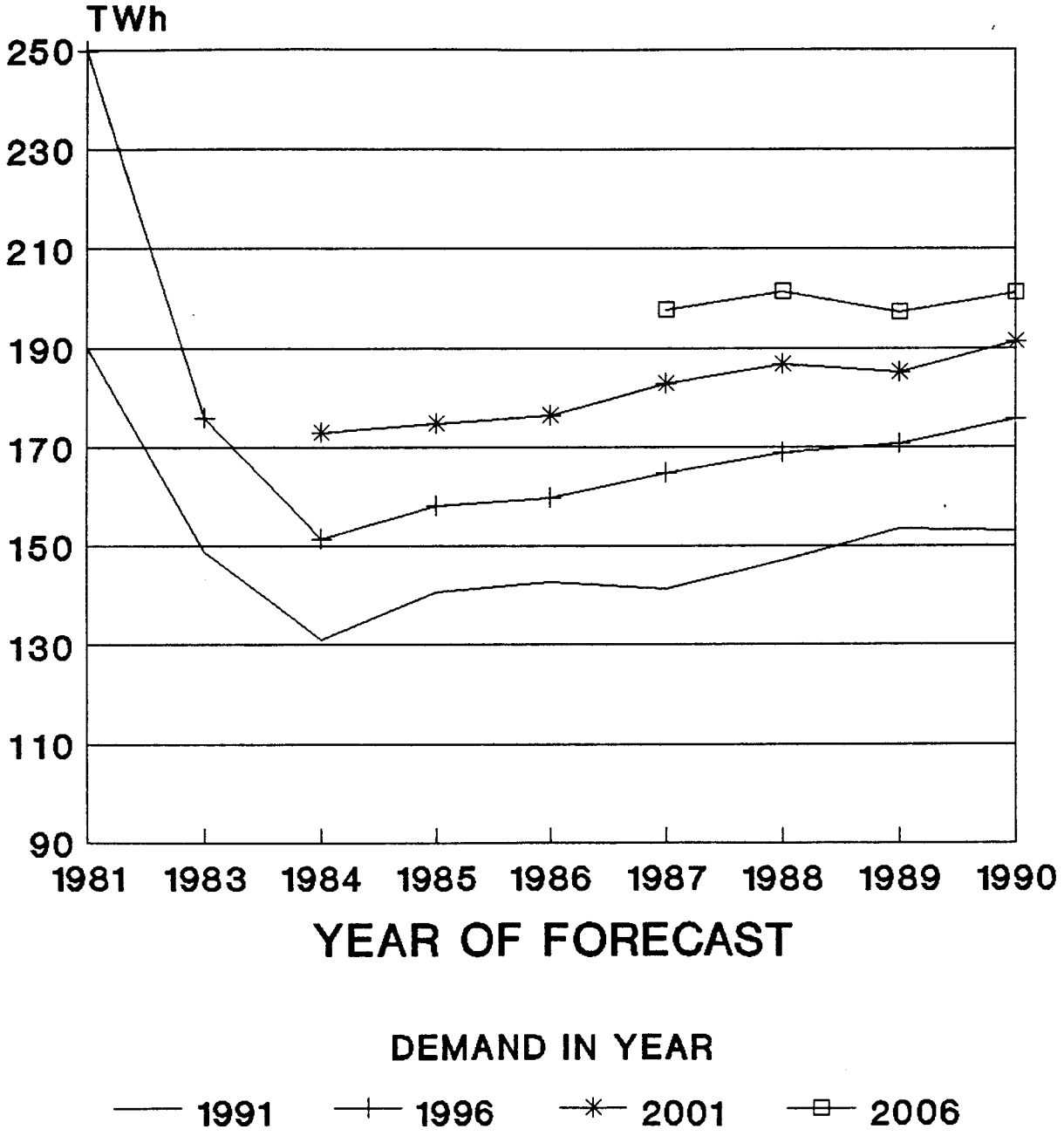

FIGURE 1.2: 1990 VS. 1989 HQ FORECAST NET INCREASE IN QUEBEC FIRM SALES

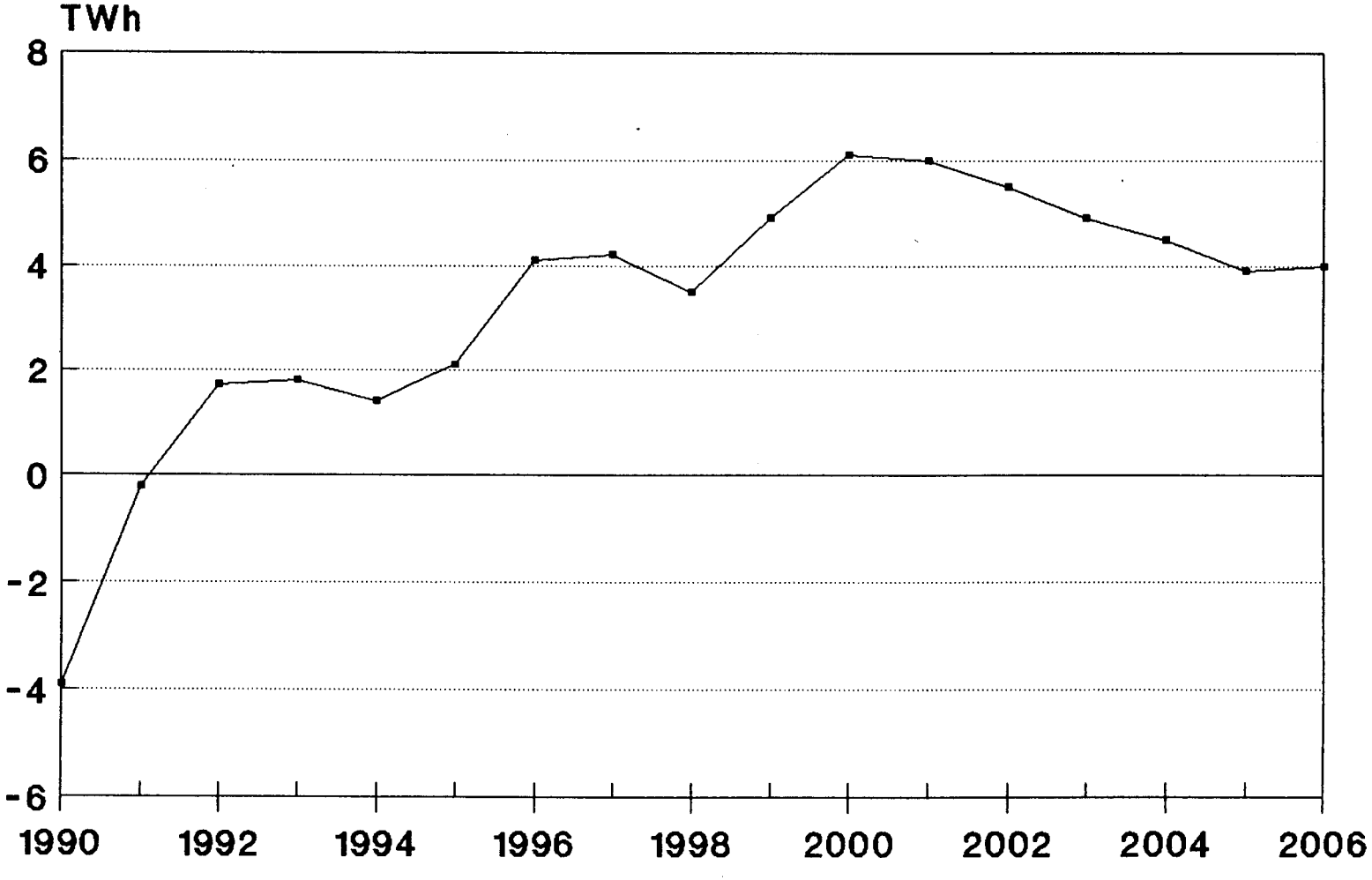

FIGURE 1.3: 1990 VS 1989 HQ FORECAST FACTORS AFFECTING DEMAND

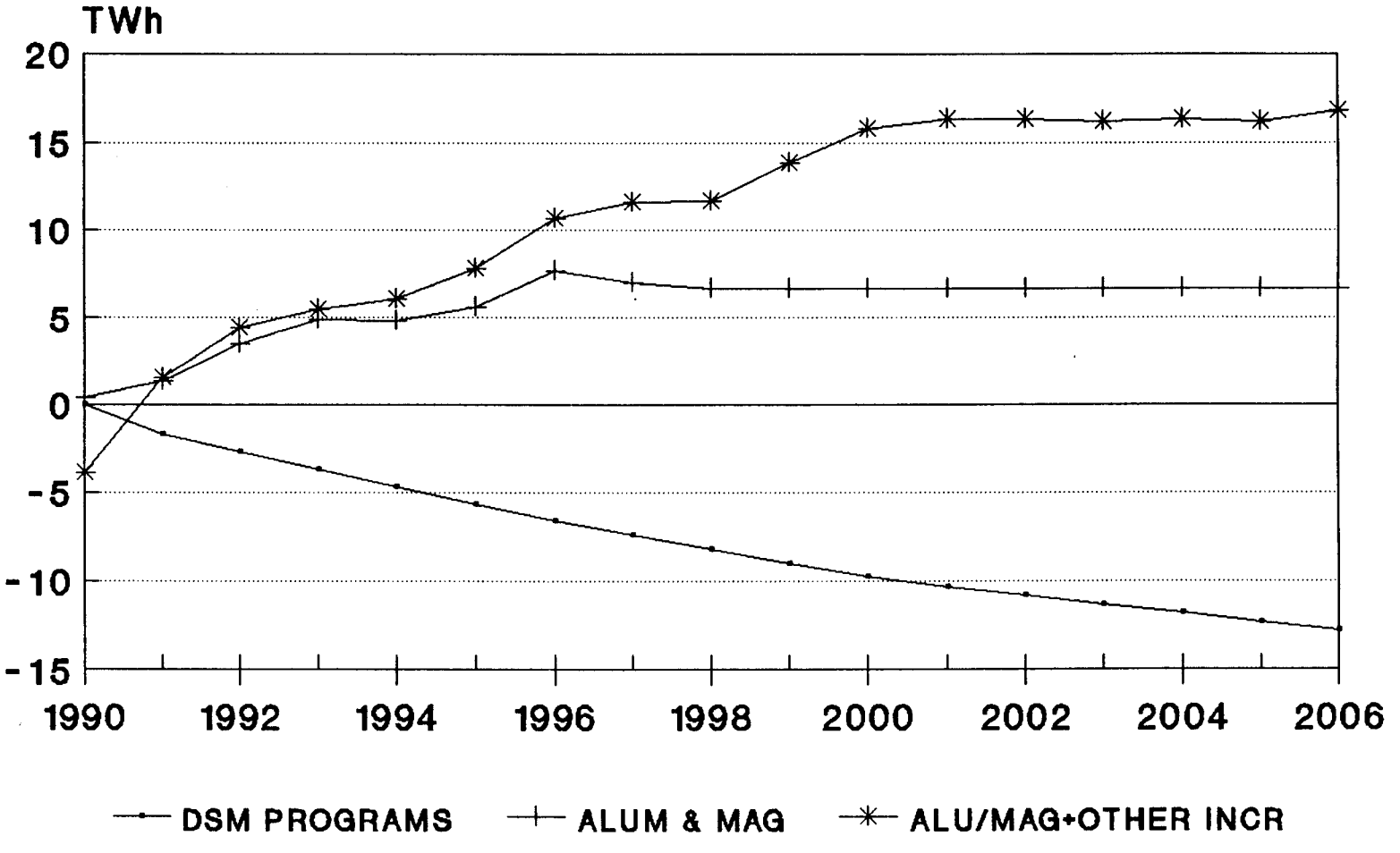

FIGURE 1.4: 1990 VS. 1989 HQ FORECAST
DSM SAVINGS AND INCREASE NET OF SMELTERS

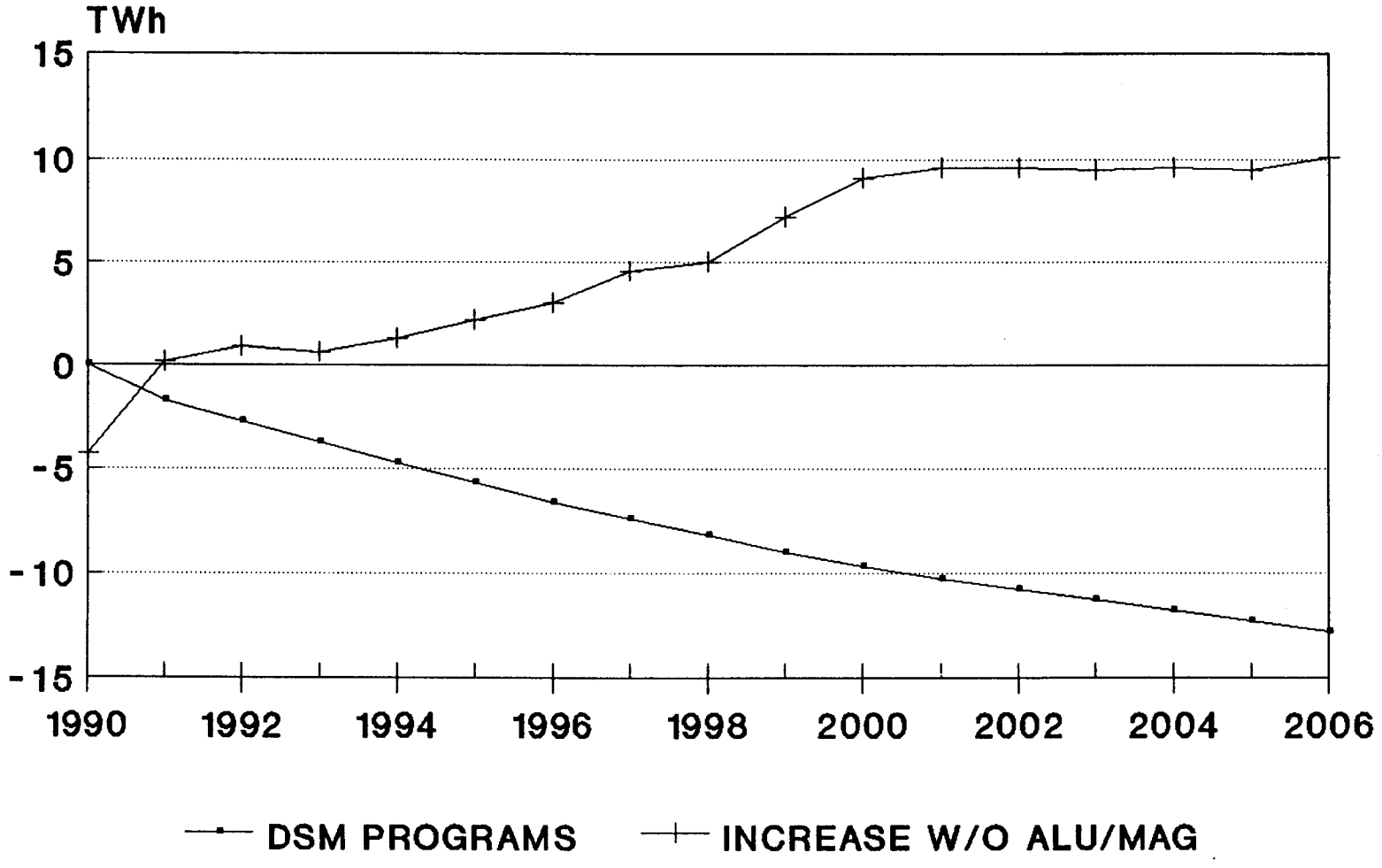

FIGURE 1.5
NET ENERGY REQUIREMENTS PER CAPITA

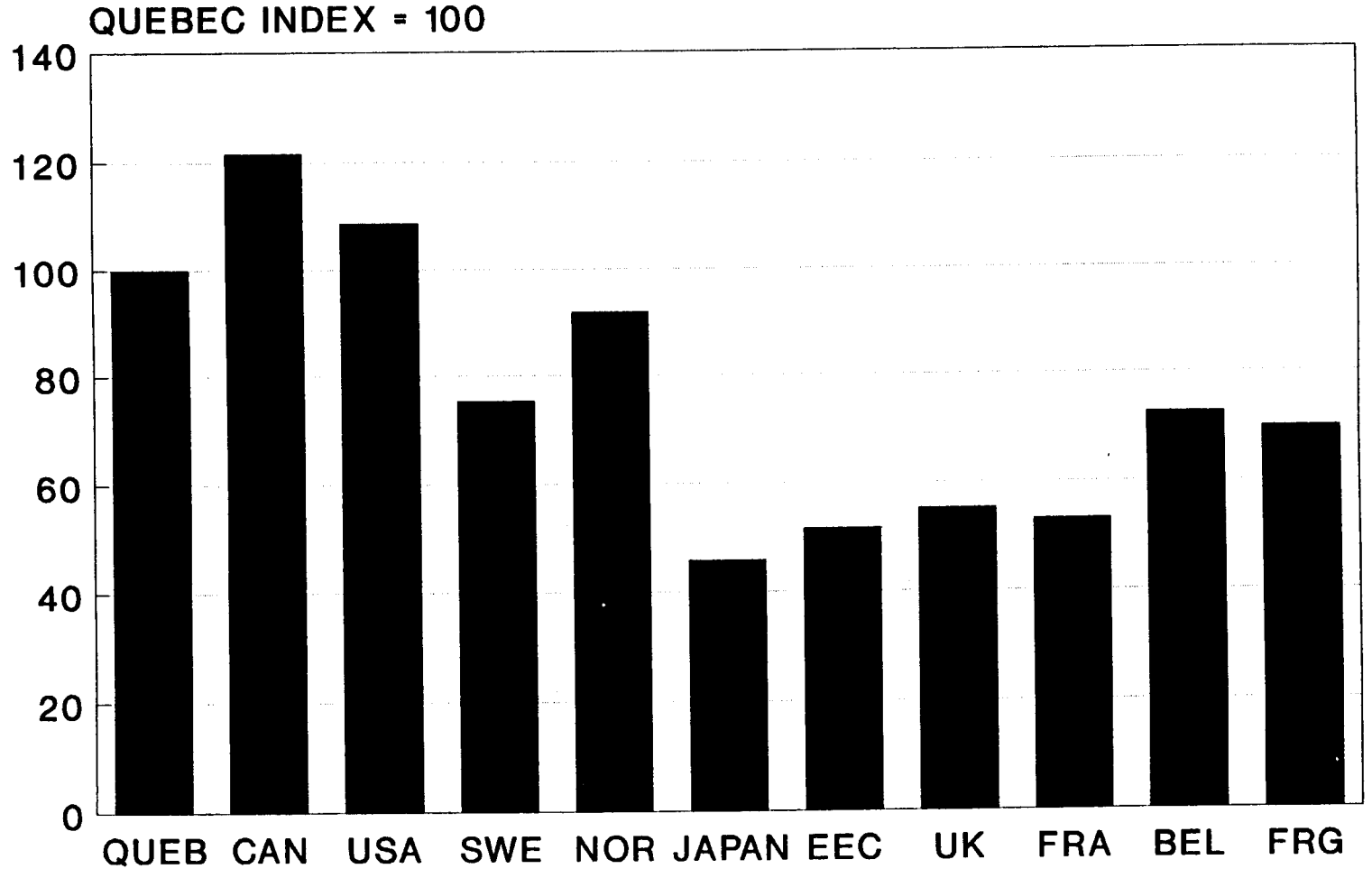

FIGURE 1.6
TOTAL ENERGY REQUIREMENTS PER CAPITA

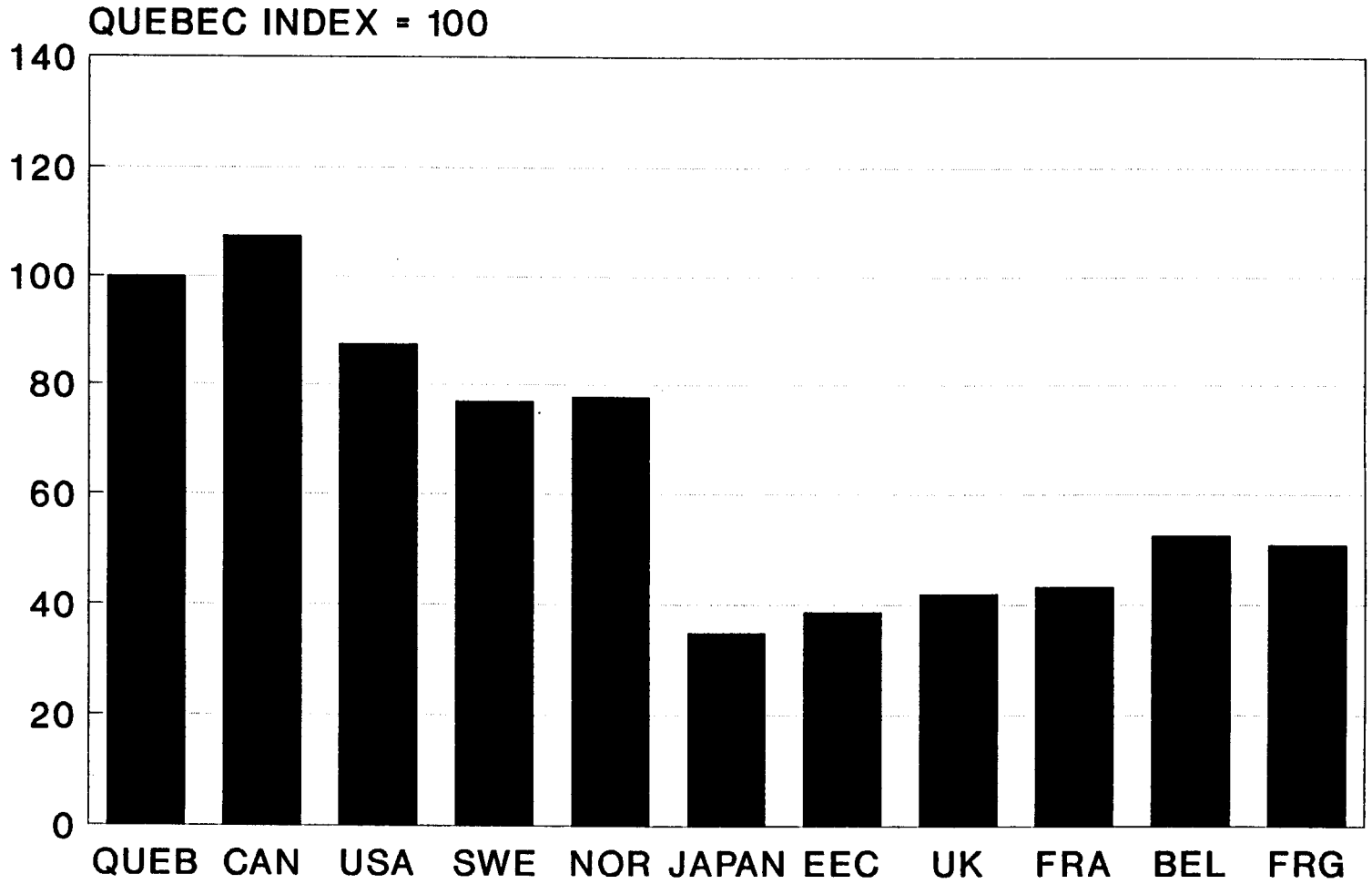

FIGURE 1.7
TOTAL ENERGY REQUIREMENTS

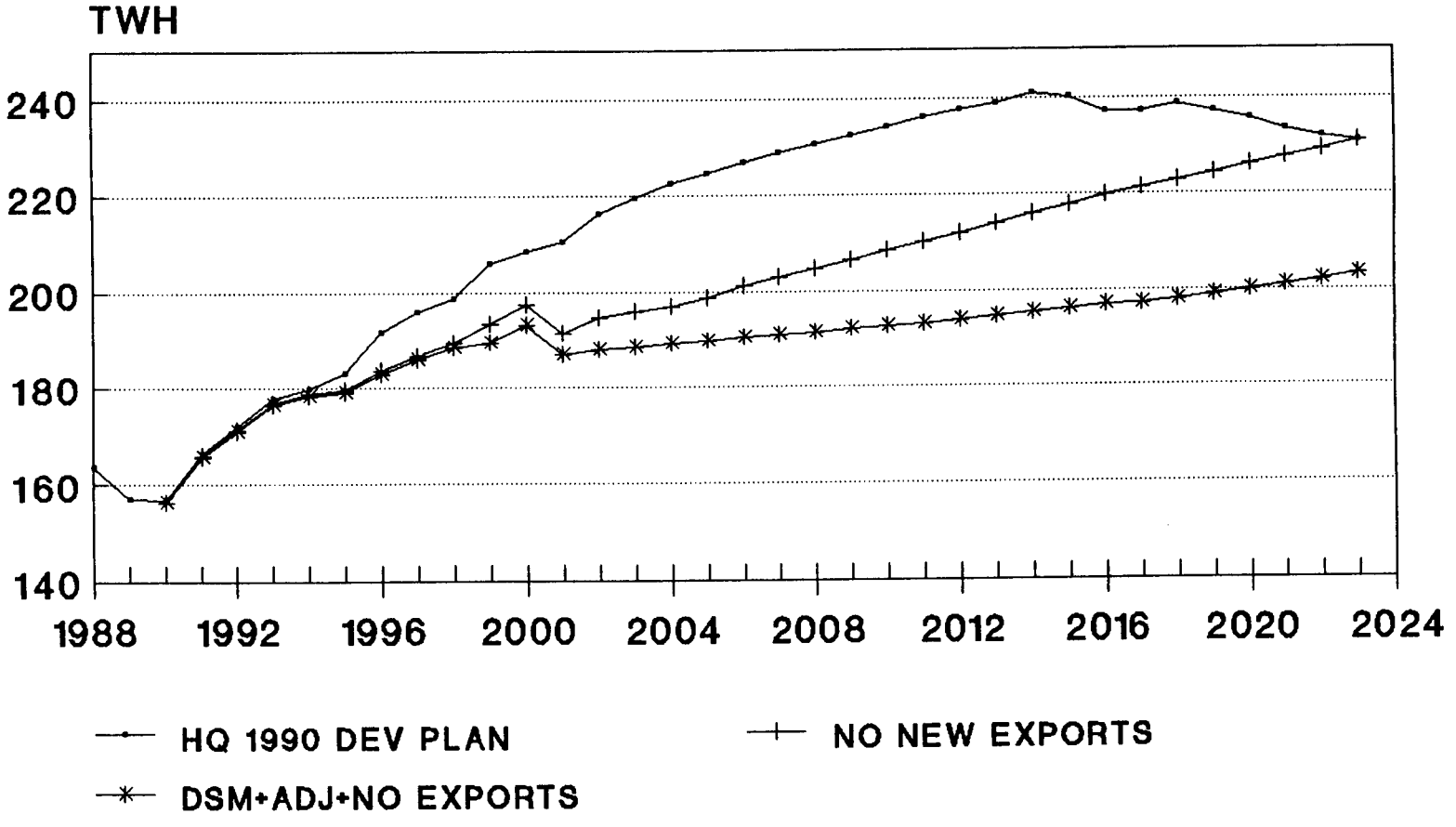

FIGURE 1.8
HYDRO RESERVES (JANUARY 1)

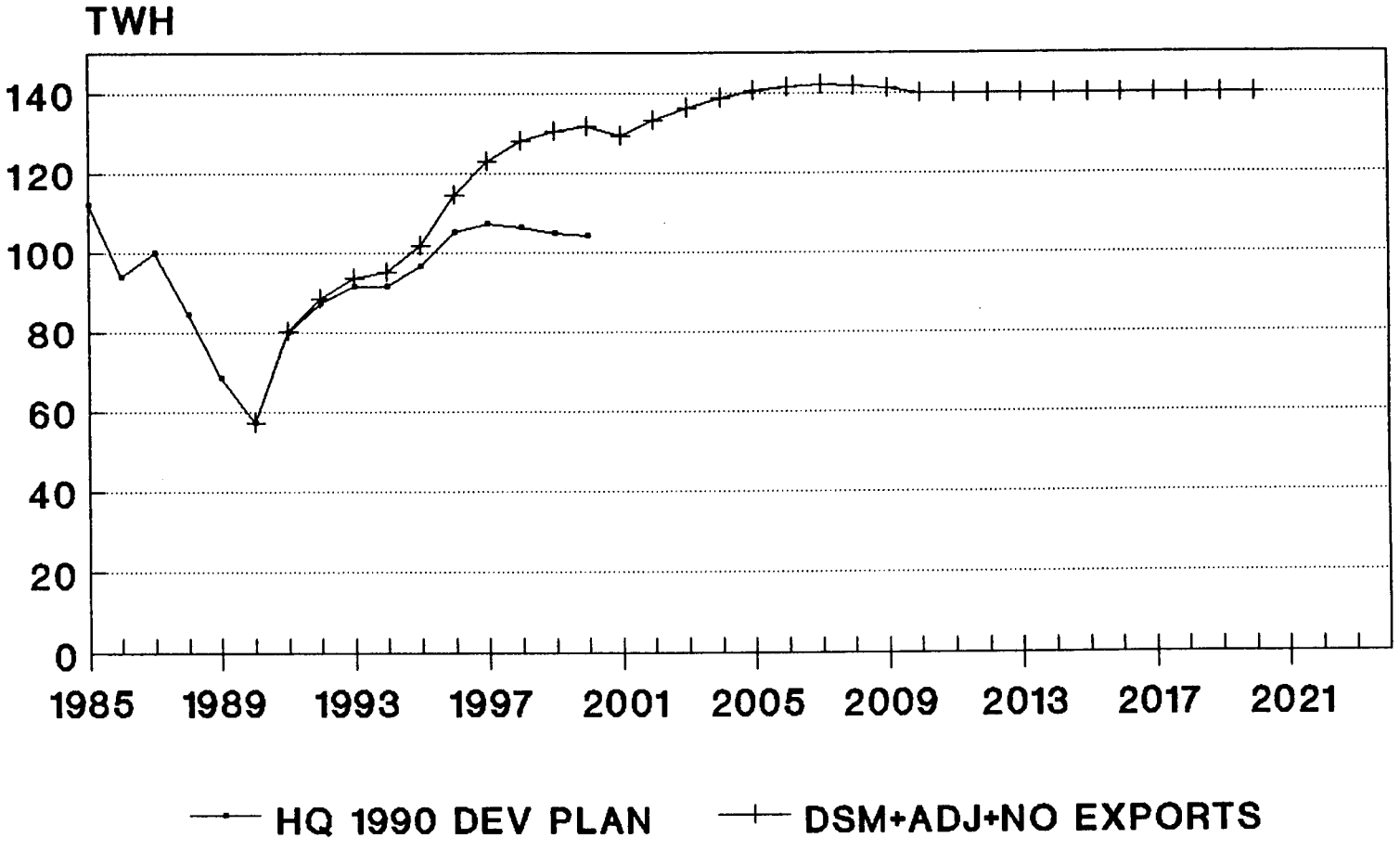

Table 1: Electricity Balance Sheet (TWH): HQ 1990 Development Plan adjusted to remove VJO and NYPA Contracts plus Forecast Adjustment and additional DSM

SUPPLY	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Hydroelectric Generation												
Run-Off	139.0	133.3	164.4	165.6	166.0	167.0	173.8	180.2	180.2	180.2	180.2	180.2
Variation	16.2	11.1	-23.2	-7.9	-5.3	-1.5	-6.8	-12.5	-8.7	-5.0	-2.4	-1.3
Spilling	-1.5	-1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sub-Total	153.7	142.5	141.2	157.7	160.7	165.5	167.0	167.7	171.5	175.2	177.8	178.9
Thermal Generation	6.0	6.9	7.7	3.9	5.3	5.1	5.0	5.0	5.0	5.0	5.0	5.0
Electricity Received	4.0	7.6	7.4	4.0	4.9	5.8	6.2	6.2	6.2	5.5	5.5	5.5
Additional Measures												
Total Supply	163.7	157.0	156.3	165.6	170.9	176.4	178.2	178.9	182.7	185.7	188.3	189.4
DEMAND												
Sales in Quebec												
Firm	119.8	127.5	126.2	134.2	139.4	145.6	147.6	150.5	155.1	158.7	161.2	165.1
(Forecast Adjustments)			(0.1)	(0.2)	(0.3)	(0.3)	(0.4)	(0.5)	(0.6)	(0.7)	(0.8)	(3.7)
(Additional DSM)												
Surplus	8.7	0.3										
Sub-Total	128.5	127.8	126.1	134.0	139.1	145.3	147.2	150.0	154.5	158.0	160.4	161.4
Sales for Export												
Firm	9.2	8.8	11.3	12.0	12.0	11.2	10.6	8.3	7.4	7.5	7.6	7.6
Surplus	7.7	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sub-Total	16.9	9.7	11.3	12.0	12.0	11.2	10.6	8.3	7.4	7.5	7.6	7.6
Total Sales	145.4	137.5	137.4	146.0	151.1	156.5	157.8	158.3	161.9	165.5	168.0	169.0
Deliveries as per Agreement	4.1	5.4	4.7	4.4	4.3	4.1	4.3	4.4	4.2	3.3	3.0	3.1
Losses	14.2	14.1	14.2	15.1	15.4	15.9	16.1	16.2	16.6	16.9	17.3	17.3
Total Requirements	163.7	157.0	156.3	165.6	170.9	176.4	178.2	178.9	182.7	185.7	188.3	189.4

Table 1: Electricity Balance Sheet (TWH): HQ 1990 Development Plan adjusted to remove VJO and NYPA Contracts plus Forecast Adjustment and additional DSM

SUPPLY	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Hydroelectric Generation															
Run-Off	180.2	180.2	180.2	180.2	180.2	180.2	180.2	180.2	180.2	180.2	180.2	180.2	180.2	180.2	180.2
Variation	2.3	-3.9	-2.9	-2.4	-1.7	-1.1	-0.4	0.1	0.7	1.3	0.0	0.0	0.0	0.0	0.0
Spilling	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sub-Total	182.5	176.3	177.3	177.8	178.5	179.1	179.8	180.3	180.9	181.5	180.2	180.2	180.2	180.2	180.2
Thermal Generation	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Electricity Received	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5	5.5
Additional Measures											1.8	2.4	3.1	3.9	4.6
Total Supply	193.0	186.8	187.8	188.3	189.0	189.6	190.3	190.8	191.4	192.0	192.5	193.1	193.8	194.6	195.3
DEMAND															
Sales in Quebec															
Firm	168.4	170.4	172.1	173.7	175.5	177.2	179.3	180.9	182.5	184.1	185.8	187.4	189.1	190.8	192.5
(Forecast Adjustments)	(3.8)	(3.9)	(4.0)	(4.2)	(4.3)	(4.4)	(4.5)	(4.5)	(4.5)	(4.5)	(4.5)	(4.5)	(4.5)	(4.5)	(4.5)
(Additional DSM)			(0.7)	(1.7)	(2.8)	(3.9)	(5.2)	(6.3)	(7.4)	(8.5)	(9.7)	(10.7)	(11.7)	(12.8)	(13.8)
Surplus															
Sub-Total	164.6	166.5	167.4	167.8	168.4	168.9	169.6	170.1	170.6	171.1	171.6	172.2	172.8	173.5	174.1
Sales for Export															
Firm	7.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Surplus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sub-Total	7.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Sales	172.5	166.5	167.4	167.8	168.4	168.9	169.6	170.1	170.6	171.1	171.6	172.2	172.8	173.5	174.1
Deliveries as per Agreement	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Losses	17.5	17.3	17.4	17.5	17.6	17.7	17.7	17.7	17.8	17.9	17.9	18.0	18.0	18.1	18.2
Total Requirements	193.0	186.8	187.8	188.3	189.0	189.6	190.3	190.8	191.4	192.0	192.5	193.1	193.8	194.6	195.3

Table 1: Electricity Balance Sheet (TWH): HQ 1990 Development Plan adjusted to remove VJO and NYPA Contracts plus Forecast Adjustment and additional DSM

SUPPLY	2015	2016	2017	2018	2019	2020
Hydroelectric Generation						
Run-Off	180.2	180.2	180.2	180.2	180.2	180.2
Variation	0.0	0.0	0.0	0.0	0.0	0.0
Spilling	0.0	0.0	0.0	0.0	0.0	0.0
Sub-Total	180.2	180.2	180.2	180.2	180.2	180.2
Thermal Generation	5.0	5.0	5.0	5.0	5.0	5.0
Electricity Received	5.5	5.5	5.5	5.5	5.5	5.5
Additional Measures	5.3	6.1	6.5	7.2	8.0	9.2
Total Supply	196.0	196.8	197.2	197.9	198.7	199.9
DEMAND						
Sales in Quebec						
Firm	194.2	195.9	197.3	198.7	200.1	201.5
(Forecast Adjustments)	(4.5)	(4.5)	(4.5)	(4.5)	(4.5)	(4.5)
(Additional DSM)	(14.9)	(15.9)	(16.9)	(17.7)	(18.3)	(18.7)
Surplus						
Sub-Total	174.8	175.5	175.8	176.5	177.3	178.3
Sales for Export						
Firm	0.0	0.0	0.0	0.0	0.0	0.0
Surplus	0.0	0.0	0.0	0.0	0.0	0.0
Sub-Total	0.0	0.0	0.0	0.0	0.0	0.0
Total Sales	174.8	175.5	175.8	176.5	177.3	178.3
Deliveries as per Agreement	3.0	3.0	3.0	3.0	3.0	3.0
Losses	18.2	18.3	18.3	18.4	18.5	18.6
Total Requirements	196.0	196.8	197.2	197.9	198.7	199.9

SUPPLEMENT

Investments in Hydroelectricity and Conservation: The Effect on Employment

Hydro-Quebec has estimated that the $ 32.6 billion[1] construction program in its 1989 Development Plan would create 317,917 person-years of employment.[2] Thus, the cost per employment-year is $ 102,600. The available data from the 1990 Development Plan indicates investment per job-year of $117,000-120,000 for the 1990-1992 period. Data from other Canadian utilities reveal similar costs per job created.[3] Since electric utilities, and particularly hydroelectric facilities, are extremely capital-intensive, it is not surprising that the cost per job is relatively high.[4]

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[1] Unless otherwise noted, all dollar figures are in 1990 Canadian dollars.

[2] Of these 317,917 employment-years, 149,902 job-years will be direct, and 168,015 will be indirect. In a 1984 study for the Bonneville Power Administration entitled Employment Effects of Energy Conservation, direct impacts are described as "labor impacts on workers hired to build or install capacity." Indirect impacts are "labor impacts on those who directly or indirectly contribute to the materials." (Bonneville, 1984)

[3] A report from the Manitoba Department of Energy and Mines, Potential Opportunities From Northern Hydro Development 4-5 (1984) indicates that a $ 3 billion nominal investment will generate 6,000 person-years of direct and 11,000 person-years of indirect employment. In 1990 dollars, this comes out to a cost of over $ 228,000 per person-year. Manitoba Hydro's January 1990 report, Perspective 2000, anticipates creation of 5,000 person-years of direct employment for a $ 1.52 billion facility presently under construction, at a cost of $ 300,000 per direct employment year. Its $ 3.9 billion Conawapa facility construction program is expected to generate 7,154 direct and 7,750 indirect employment-years over the next decade. This results in a cost of $ 337,000 1990 dollars per direct job-year, or $ 162,000 per employment-year for all direct and indirect jobs generated. (Manitoba Hydro, 1990a)

[4] Data from the 1989 HQ Development Plan indicates dollars spent for various categories of Hydro-Quebec's construction operations. It should be noted that costs per job-year are higher for generation than for any other specific category:

generation	$ 120,487
transmission	$ 90,366
subtransmission	$ 90,367
distribution	$ 76,673
other	$ 148,834
average	$ 102,619

Those figures stand in sharp contrast to the number of jobs created through investments in conservation programs. A study for the New England region showed that conservation programs generate direct and indirect employment at a cost of approximately $ 52,000 per employment-year. (Report to the Congress, 1983) A report for the Pacific Northwest region of the United States provides similar estimates. (Bonneville Power Administration, 1984)[5] Work done by Ontario Hydro indicates that the job-creation and income impacts of conservation compare favorably with alternative sources of supply when reviewed on a megawatt-hour basis.[6]

An additional employment impact of expenditures on conservation programs relates to the "real income" or "substitution" effect. A study for California stated that investment in all energy technologies, including both generation and conservation, results in less employment than the average dollar spent in the economy. However, since investments in conservation decrease energy bills, capital is freed up for consumption or investment elsewhere in the economy. Additional jobs resulting from respending, the study concludes, "would be at least five times greater than jobs created by a power plant." (California Energy Commission, 1979)

In fact, the major employment impact of conservation programs is not as a result of jobs generated directly or indirectly, but rather as a result of reduced energy expenditures. Estimates are that the real income effect may generate twice as many jobs as direct and indirect employment impacts combined. (Bonneville, 1984)

Furthermore, large-scale investment in power plants may actually produce net reductions in overall employment. This occurs when investments in new generation facilities are so high that consumers are forced to reduce expenditures on other goods and services in order to finance construction, either directly or indirectly. (Bonneville, 1984) In Quebec, rate increases which

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[5] The Bonneville report states "A reasonable estimate seems to be that $ 1 million of expenditure on a residential or commercial program will lead to 15 or 20 direct job years." In 1990 Canadian dollars this comes to approximately $ 76,000 - 102,000 per direct person-year. However, other studies show that at least as many indirect positions are created in conservation programs, so the total cost per job generated is likely to be somewhat less than 50% of the above figures.

[6] Ontario Hydro concluded that high load factor (e.g. industrial) conservation and low cost domestic fuel cogeneration would generate significantly higher economic impacts per Mwh than all non-nuclear supply options. Low load factor (such as residential) conservation would yield economic impacts roughly comparable to coal plants and peaking hydro. (Ontario Hydro 1987; Ontario Hydro, 1987a, cited in Manitoba Hydro, 1990)

will be levied on consumers to support Hydro-Quebec's massive investment in new hydro construction will probably contribute to a meaningful reduction in provincial employment opportunities in this decade.

In addition, there are several other advantages of investing in Demand Side Management strategies over large-scale electric-generation projects having to do with the timing, skills requirements, and location of the jobs created.

Unlike megaprojects, conservation programs offer substantial flexibility in terms of rate of implementation. Utilities can invest incrementally with little required lead time. Thus, conservation programs can be accelerated to create employment during cyclical periods of joblessness.

Further, the mix of skills required for workers on large generating projects is quite different than that required for energy efficiency programs. While the former requires a higher level of specialized skills, DSM programs rely less on specifically trained employees and can therefore offer a higher percentage of jobs to locally available labor.[7]

Finally, the location of employment is important. Conservation programs would create jobs in southern Quebec, while jobs related to hydro construction would be concentrated in the northern portion of the province. It has been noted that construction of power plants in isolated locations generally creates a "boom town" effect with "accompanying social and economic problems." (Bonneville, 1984) Conservation programs, dispersed throughout populated areas of the province, would avoid this problem.

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[7] Moreover, it is the untrained laborer who is most adversely affected during economic slowdowns. (Bonneville, 1984) Thus, conservation programs may be more effective in mitigating the effects of economic recessions than investments in new generating facilities.

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ANNEX B

THE HYDRO-QUÉBEC JAMES BAY PROJECT
Testimony of the Natural Resources Defense Council
For the Québec Crees

Submitted by:
Eric Washburn
Ralph Cavanagh
Jacqueline Warren

The Hydro-Quebec James Bay Project
Testimony of the Natural Resources Defense Council
For the Quebec Crees

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Eric Washburn
Ralph Cavanagh
Jacqueline Warren
May 16, 1990

The Natural Resources Defense Council (NRDC) is a private, non-profit organization with over 130,000 members. Founded in 1970, NRDC now has offices in New York, Washington DC, San Francisco, Los Angeles, and Honolulu. For more than a decade, NRDC has had programs focussing on both domestic and international energy issues, particularly the relationship between environment and energy development. The work of NRDC's staff of 80 lawyers, scientists, and resource specialists is supported by its membership and numerous foundations.

A. INTRODUCTION

Before undertaking further expansion of the James Bay Project, Quebeckers should recognize that improvements in electric end-use efficiency constitutes an energy resource, not merely equivalent, but in fact superior, to the construction of new generating capacity. Through a variety of avenues, which we shall explore in this testimony, investments in energy efficiency by Quebec can economically alleviate the need to construct additional generating capacity in the reasonably foreseeable future.

Broad-based, readily achievable gains in end-use efficiency of at least 27,000 GWh and 5645-6015 MW peak demand are possible in Quebec by 2001 through concerted regulatory actions and the provision of financial incentives by both the Provincial

government and Hydro-Quebec.[1] These estimates do not include future economies of scale in producing and delivering energy-efficient technologies, the introduction of new efficiency technologies, or savings that Quebec could achieve by recycling metals, glass, plastics, and paper, which has numerous environmental benefits aside from energy conservation.

Regulatory reforms that could contribute substantially to increased energy efficiency in Quebec include adoption of building codes that require the use of heavily insulated walls, ceilings, windows, and floors, and energy-efficient lighting fixtures and electric ballasts. Efficiency standards for major appliances, such as refrigerators, water heaters and heating and cooling systems could also be developed and implemented.

Quebec should use least-cost energy planning to rank and select energy resource options based on cost per unit of energy delivered. Where possible this should include an accounting of both the market prices and environmental costs associated with each option, to ensure that equitable comparisons are made.

Retrofitting existing buildings could be accomplished through financial incentives, such as rebates, where Hydro-Quebec

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[1] Joint Testimony of William Marcus and Ian Goodman, "Hydro-Quebec Applications to Export Electricity to the New York State Power Authority and Vermont Joint Owners", submitted to the Quebec National Energy Board, February 14, 1990.

would reimburse customers for replacing old lighting fixtures and incandescent bulbs with new fixtures and compact fluorescent bulbs. In the Pacific Northwest, the cost of retrofitting existing homes to Model Conservation Standards (MCS) has dropped by roughly 60% in five years, due, in part, to improved techniques and builder experience.[2]

In addition, the Provincial government can seek to increase the energy efficiency of materials manufacturing through an accelerated municipal solid waste recycling program. Considerable energy savings are possible through the recycling of numerous secondary materials (e.g., aluminum, paper and paperboard, steel, glass, and plastics), in comparison with manufacturing of these same products from virgin raw materials.

The small scale, reduced risk, and flexibility inherent in efficiency investments also recommends their adoption. Moreover, unlike power plant construction, conservation potential tracks demand growth in a very advantageous manner.[3] Growth in electricity demand is a function of general economic expansion, which provides increased opportunities for efficiency improvements. Moreover, large-scale efficiency programs reduce

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[2]Bonneville Power Authority, "Big Savings from Small Sources," Backgrounder, BPA, March 1990.

[3]Cavanagh, R., 1986. "Least-Cost Planning Imperatives For Electric Utilities And Their Regulators," Harvard Environmental Law Review, 10:299-344.

costly uncertainty about future electricity needs by minimizing the energy-related impact of utilities' errors in predicting the future energy demand of buildings and appliances.

B. LEAST-COST ENERGY PLANNING IN QUEBEC

Probably the single most important action that Quebec could take to ensure adequate energy supplies and to reduce the ecological impacts of delivering electricity would be to fully implement integrated least-cost planning. Least-cost planning shifts the conception of utilities' function from providing energy supplies to delivering energy services. Quebeckers place no value on kilowatt-hours, per se. Rather, they desire the services that energy provides, such as light, comfortable indoor temperatures, food preservation, and motive power. If these services can be provided at lower overall cost using less energy no one will lament the kilowatt hours and therms that they did not need to consume, and both the environment and the economy will be better off.[4]

Providing an appropriate regulatory framework for Hydro-Quebec is an essential step to promoting energy efficiency in each end-use sector. Throughout the United States, electric

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[4] Cavanagh, R.C., 1989, "Global Warming and Least-Cost Energy Planning." Annual Review of Energy, 14:353-373.

utilities have increasingly been directed to adopt least-cost planning criteria in meeting electricity demand. At least 17 states now require some form of least-cost planning in the utility sector. There is a great deal that Quebec can learn from the experience that has been rapidly accumulating since the passage of the Northwest Electric Power Planning and Conservation Act by the Congress in 1980 in the Northwest, California, and the Northeast.

In particular, there are numerous examples from the Bonneville Power Administration (BPA) to illustrate potential, cost-effective energy savings. Bonneville is the U.S. entity most closely analogous to Hydro-Quebec; it markets power from 30 hydroelectric dams in the Pacific Northwest. Over the last 10 years, BPA has invested nearly $900 million in energy conservation efforts in the industrial, commercial, and residential sectors, achieving energy savings of at least 300 average MW (2.6 million MW/yr) at an average cost of $.02/kWh (see table 1). Investments in new, large-scale power generation have been deferred indefinitely. By 2010, BPA expects to have achieved regional savings of 1,160 average MW, 754 of which are expected to result from Oregon and Washington building codes and Federal appliance standards.[5] Lessons from the Bonneville

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[5]Bonneville Power Administration (BPA), Office of Energy Resources 1987/1988 Yearbook, DOE/BP-1125 (Washington DC: U.S. Government Printing Office, August 1989).

experience are relevant for any Provincial utility contemplating future investments in energy conservation programs.

Table 1

Summary of BPA's Conservation Investments Through 1989

Activity	Savings	Cost to BPA*	Life-cycle Cost
RESIDENTIAL SECTOR			
Weatherization	87 MW	393	2.7¢/kWh
Water Heater Wraps	37 MW	34	2.6¢/kWh
COMMERCIAL SECTOR			
Lighting	16 MW	49	2.3¢/kWh
INDUSTRIAL SECTOR			
Modernization	95 MW	46	0.6¢/kWh
Energy Savings Plan	3 MW	3	0.4¢/kWh
AGRICULTURAL SECTOR			
Irrigation	3 MW	2	2.0¢/kWh
Totals (Evaluated)	**241 MW**	**527**	**1.8¢/kWh**
Total (Estimated)	**50 MW**	**75**	**3.0¢/kWh**
Additional Savings			
MODEL CODES/STANDARDS	100-400 MW	129	N/A

* $millions

Source: Bonneville Power Administration, Backgrounder, March 1990.

Hydro-Quebec has stated its intention to provide power at the lowest social cost.[6] This can only be accomplished using a consistent least-cost methodology that includes environmental considerations in the evaluation of various forms of energy investments. Least-cost plans should incorporate an environmental preference for efficiency measures and supply sources with fewer environmental impacts, (i.e., technologies that avoid large-scale ecological disruption and emissions of acid-forming pollutants and greenhouse gases).[7]

No Losers Test

It is important for Quebec to realize that substantial regulatory reform may be necessary to achieve potential efficiency gains in the future. Constructing a system that encourages competition between conservation and new power generation must bring down barriers that have traditionally impeded such competition and prevented equitable comparisons from

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[6]Hydro-Quebec, 1990. Proposed Hydro-Quebec Development Plan 1990-1992-Horizon 1999 (Hydro-Quebec and Energy Efficiency), p.6.

[7]See, e.g., Massachusetts Department of Public Utilities, DPU 86-38 (November 30, 1988), in this order, the state required that "evaluations of the cost-effectiveness of [conservation] programs and other resource options should...include, to the fullest extent practical and quantifiable, costs and benefits external to the transaction, most notably environmental externalities," (p.22); Washington Utilities and Transportation Commission, Proposed Rule (Chapter 480-107 WAC), the State will rank project proposals for energy resources based on "risks imposed on ratepayers and environmental effects."

being made. Moreover, incentives must be provided for individuals to participate in conservation programs. Currently, consumers tend to require returns of 30-200 percent on investments in energy efficiency, due to the reluctance of individuals to make investments that will reward subsequent occupants.[8]. This is much higher than the rate of return required by utilities to invest in new generating capacity, and creates a barrier to energy conservation to conservation investments.

Another barrier that will prevent Quebec from achieving its cost-effective conservation potential is the use of a criterion known as the "no-losers test." Hydro Quebec has adopted a "no losers test" by placing a cap on energy conservation investments equal to "the difference between marginal construction project costs....and revenue loss brought on by energy conservation."[9]

While this criterion is intended to prevent higher electricity rates for those who decide not to participate in conservation programs, its effect will be to discriminate against improvements in efficiency, with the result being that less than economically optimal investments in conservation will be made by

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[8]Cavanagh, R., 1986, supra at nore 3.

[9]Hydro-Quebec, 1990., supra at note 6.

Hydro-Quebec and its customers.[10] As a result of these effects, the test has explicitly been rejected by a number of states and power authorities, including Massachusetts, Idaho, Wisconsin, California, Vermont, Washington DC, Maryland, Connecticut, Maine, the Bonneville Power Administration, and the Northwest Power Planning Council, as well as Ontario.[11] Idaho, for example, in rejecting the "no losers test," required that the full avoided cost of producing electricity be the upper limit for utilities' conservation payments.[12]

This problem results because conservation may increase rates more than the construction of new generating capacity. Investments in conservation result in the consumption of fewer kilowatt-hours over which the utility can spread its system's fixed operating costs. Consequently, although rates increase to recoup conservation costs, bills are reduced for consumers as a group. An exclusive focus on rates, rather than bills, ensures that there is less incentive than is economically desireable to

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[10]Cavanagh, R., 1986, supra at note 3.

[11] Calwell, C., and R. Cavanagh, The Decline of Conservation at California Utilities: Causes, Costs and Remedies, Natural Resources Defense Council, Energy Program Special Report, July 1989, Appendix 2; personal communication, Eric Washburn, NRDC and Ian Goodman, The Goodman Group, Boston, May 9, 1990; for examples of public orders of rejection see Massachusetts Department of Public Utilities, DPU 86-36 (November 30, 1988) pp.22-23; and Idaho Public Utilities Commission, Order No. 22299, Case No. U-1500-165 (January 27, 1989) p.16.

[12]Idaho Public Utilities Commission, Order No. 22299, Case No. U-1500-165 (January 27, 1989), pp.16-17.

invest in efficiency gains. It has been shown that in some cases under the "no losers test" conservation options will be rejected even if they cost utilities nothing:[13]

> Assume a utility with current average rates of 8 cents/kWh, supply-side options costing 7 cents/kWh, and demand-side resources that are available for free....[T]he supply-side options reduce average rates to 7.8 cents. However, the demand-side resources still leave average rates at 8 cents. The demand-side measures are therefor rejected under the no-losers test, even though they reduce total revenue requirements and average bills by 15%.[14]

To obtain optimal investments in energy efficiency, Quebec should prohibit the application of the "no-losers test" criterion. The distributional objectives of the test can be met by providing widespread opportunities to participate in conservation. In failing to prohibit the test, Quebec will, in effect, be subsidizing the generation of new power at the expense of cheaper conservation measures.

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[13]Calwell, C., and R. Cavanagh, 1989, supra at note 11.

[14]Submission presented by John Plunkett to the National Association of State Utility Consumer Advocates, Mid-Year Meeting, Washington, D.C. (June 18-20, 1987).

C. ENERGY EFFICIENT TECHNOLOGIES

Technologies that could have a substantial impact on future energy demand include highly-efficient heat pumps, heat exchangers, super-insulated windows and walls, more efficient fluorescent lighting and ballasts, computerized industrial process controls, industrial waste heat recovery, and packaged cogeneration systems. The following sections discuss existing and developing technologies, which if implemented, will expand the energy resources of Hydro-Quebec. California's four principal utilities have recently announced plans to invest more than $560 million over the next two years in many options described below.[15]

a. Residential and Commercial Sectors

Examples of opportunities for more efficient energy use in the residential and commercial sectors abound. Least-cost analyses by both government and public interest organizations have shown the potential for savings typically from 30% to more than 90% of current energy use at attractive costs for each of the several dozen end-uses of energy. Commercial lighting, appliances, and space heating and cooling systems and water

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[15] Report on the State Wide Collaborative Process: An Energy Efficiency Blueprint for California, (January 1990).

heating are four particularly promising areas for which efficiency potentials have been well characterized.

1. Commercial Lighting

Commercial lighting systems offer large amounts of conservation at exceptionally low cost. In some cases, the net cost of efficiency improvements is essentially zero, because the more efficient equipment results in lower first costs and lower labor costs than conventional practice. The potential to save 75% or more of the energy used by a typical commercial lighting system with an attractive rate of return has been demonstrated in practice.[16]

The efficiency improvements are achievable through a rapidly increasing menu of technologies, including more efficient bulbs, more efficient ballasts, better controls, including those that allow the possibility of dimming, new fluorescent technologies to substitute for much less efficient incandescent sources without adversely affecting lighting quality, the use of daylighting to replace artificial illumination during the daylight (peak load) hours, and more efficient fixtures, which could reduce glare and

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16 David B. Goldstein, "Demonstrating State-of-the-Art Energy Efficiency in Lighting," Presented at the 1989 IES South Pacific Coast/Pacific Northwest Bi-Regional Conference, South Lake Tahoe, Nevada, April 18, 1989.

improve lighting quality, as well as save energy. Future advances in fluorescent lighting will come from reducing self-absorption, and increasing both phosphor efficiency and ballast frequency.

Most conservation programs in the past have focused on a limited number of these options and failed to achieve the full cost-effective potential. NRDC has demonstrated the impact of applying these measures in combination by installing all available lighting technologies with a rate of return from lower electric bills greater than our actual cost of capital when our New York headquarters was remodeled. The power requirements are approximately 0.5 Watts per square foot, one-sixth of many existing buildings and one-third to one-fourth of typical new construction.[17]

To achieve electricity demand reductions, a number of utilities in the U.S. have begun offering rebates for retrofitting commercial buildings with more efficient lighting systems. For example, the Potomac Electric Power Company (PEPCO) in Washington DC and Maryland, and six utilities in Washington State have established rebate programs that reimburse commercial

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[17] Goldstein, 1989, supra at note 16.

building owners for retrofitting with high efficient lighting, ballasts, fixtures, and motion sensors.[18]

2. Appliance Efficiency

Improvements in appliance efficiency offer another major target of least-cost planning. Appliance efficiency savings typically cost one-tenth to one-quarter as much as new power plants. For baseload appliances such as refrigerators and water heaters, the cost of conserved energy is significantly less than the operating costs of existing power plants. In the U.S. the National Appliance Energy Conservation Act, passed in 1987, will produce significant efficiency improvements.

Technical improvements currently marketed or still being developed will affect a wide range of appliances. Efficiency improvements in ovens/cooktops, refrigerators, and clothes dryers illustrate potential energy savings. Improvements in insulation, door seals, and oven element configuration will reduce energy consumption from food preparation. In addition, bi-radiant ovens and induction cook tops represent substantial improvements in

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[18]Potomac Electric Power Company (PEPCO), letter from Tamberly Koenig, PEPCO Commercial Energy Services, to Eric Washburn, NRDC, dated March 6, 1990; Bonneville Power Administration,1989. Office of Energy Resources 1987/1988 Yearbook, DOE/BP-1125, (Washington DC: U.S. Government Printing Office).

efficiency over existing models.[19] While the induction cook-top is not cost-effective at the present time, it is likely its cost will diminish as more models are developed and marketed.

Improvements in refrigerator design and technology will result from greater insulation and more efficient compressors. Dual compressor systems will save 25% of the energy required by refrigerators using single compressors. Condenser anti-sweat heaters, and aerogel insulation also offer large improvements over existing models. State-of-the-art refrigerators available with these improvements consume about 15% of the energy required by typical models.[20]

Microwave drying techniques and dryers equipped with heat pumps and temperature/moisture sensors will reduce energy requirements for clothes drying in the future.[21] Heat pumps alone save about 70% of the energy needed to operate conventional dryers.

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[19]Goldstein D, R. Mowris, B. Davis, and K. Dolan, 1990. "Initiating Least-Cost Planning in California: Preliminary Methodology and Analysis," presented to the California Energy Resources Conservation and Development Commission (February 21, 1990).

[20]For comparisons, see Cavanagh, R., 1986, supra at note 3; Goldstein et al. 1990, supra at note 19.

[21]Goldstein et al. 1990, supra at note 19.

In the area of commercial lighting and appliances, incentive programs designed to bring new technology into the marketplace, rather than just encourage adoption of existing technology, could play a major role. One problem in these areas is that technologies that are feasible in the laboratory, or available commercially in very limited production, would be cost-effective if expanded to the whole sector. However, least-cost planning efforts recently initiated in the U.S. will undoubtedly lead to future economies of scale in the production and marketing of energy-efficient technologies.

3. Space Heating and Cooling Efficiency

State-of-the-art technologies and those currently being developed will expand the magnitude of future energy savings. Advanced electric and thermally-activated heat pumps will add to the menu of options for more efficient heating and cooling. New wall insulation technology, such as evacuated panels, can sharply reduce heat loss. Highly insulated windows capable of being switched from opaque on winter nights to transparent during the day could provide additional savings.

Opportunities for improving the energy efficiency of both new and existing buildings in Quebec. Some regulatory reforms will be necessary to achieve this potential. For example, to

ensure that all building owners have an incentive to make efficiency investments, Quebec could require that average annual energy costs be disclosed in all real estate transactions (both sales and leases).

New Buildings

Major improvements can be made in space heating and cooling efficiency, both in new and existing houses. Well insulated new houses in the Pacific Northwest were measured to use approximately 3.3 kilowatt hours per square foot (kWh/ft^2; actual measurement of commercially produced houses) for space heating in a climate of approximately 5000 heating degree days. Typical energy consumption in this region of the U.S. is 8 kWh/ft^2. The Hood River Conservation Project brought heating energy consumption down to approximately 4 kWh/ft^2 per year in existing houses, even controlling for the effect of wood heat.[22]

Well designed commercial buildings should require few heating energy inputs, as heat from lighting, equipment, and occupants should provide much of the heat required by buildings. Increased insulation in residential buildings and increased commercial lighting efficiency will also reduce cooling loads.

Existing Buildings

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[22] Hirst, Eric, "The Hood River Conservation Project: Cooperation and Community Conservation, June 1987, Comprehensive Report." Prepared for Pacific Power & Light Company and Bonneville Power Administration.

While retrofitting existing buildings is less effective than "building it right" in the first place, Quebec's existing building stock nevertheless represents a substantial potential energy resource that can be "mined" with well designed retrofit programs. Energy audits sponsored by the Provincial government or Hydro-Quebec could provide one means of identifying and exploiting opportunities for increased building efficiency. Improvements to existing building structures have an estimated lifecycle savings of roughly 30 years.[23] There may be substantial potential for energy efficiency improvements through retrofitting commercial office buildings, hospitals and schools. In the U.S., the federal Institutional Conservation Program has saved 0.1 quads per year from financing building retrofits.[24] Energy savings from weatherization of existing homes in the Pacific Northwest cost 2.7¢/kWh, while adding insulating wraps to hot water heaters cost 2.6¢/kWh on a lifecycle basis.

In addition, cooling equipment itself can be significantly improved. Adding economizer cycles to existing air-conditioning systems and using high efficiency components when replacing worn out equipment or when installing new equipment can reduce electricity demand considerably. Commercial cogeneration also

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[23]Bonneville Power Administration, 1990, supra at note 2.

[24]Hirst, 1989, Federal Roles to Realize National Energy-Efficiency Opportunities in the 1990s, ORNL/CON-290, (Oak Ridge National Laboratory: Oak Ridge, TN, October 1989).

holds a large potential for future energy savings. Over 600 cogeneration systems are currently operating in commercial facilities in the U.S (e.g., hotels, hospitals).[25]

Building Codes/Standards

Quebec could play a central role in promoting energy efficiency in buildings by establishing stringent building efficiency standards. Adoption of building standards would ensure that all new construction is performed using state-of-the-art technology, while resulting in savings over a lifecycle that averages 70 years for homes. Failure to capture the full energy efficiency potential in new construction creates irrevocably lost opportunities to obtain cost-effective conservation resources.

Actions undertaken in the U.S. provide examples Quebec can use in designing its own codes. Model energy-efficient building codes for residential and commercial buildings have been developed by the U.S. Department of Energy, the California Energy Commission, and the Northwest Power Planning Council. The State of Washington has adopted the Model Conservation Standards (MCS), developed by the Northwest Power Planning Council for residential buildings, as law.

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[25]Oak Ridge National Laboratory, Energy Technology R and D: What Could Make a Difference? ORNL-6541/V2/P1, U.S. Department of Energy, (Washington DC: U.S. Government Printing Office, December 1989).

In the housing and commercial building construction industry, computer-assisted design, building control and energy performance analysis, motion sensors, high frequency solid state ballasts and highly insulated building shells may all play a significant role in efficiency improvements.[26] "Smart" houses may be available in the future that integrate motion sensors, computer building control and more efficient cooling and heating systems to substantially increase energy efficiency in the residential sector.

A provincial regulation requiring existing buildings to meet energy-efficiency standards is another way to "mine" the resource represented by existing buildings; such a regulation would capture cost-effective conservation either at the point of sale or at the point of significant renovation. San Francisco has enacted such requirements for its commercial buildings

b. Industrial Energy Use

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[26]Oak Ridge National Laboratory, 1989, supra at note 25.

In the industrial sector there are vast opportunities to increase productivity and cut emissions. The Bonneville Power Administration found that investments in energy efficiency in the industrial sector provided substantial returns at minimal cost; saved energy averaged 0.4¢-0.6¢/kWh.

1. General Technologies

New high efficiency motors and variables speed drives can substantially cut total electricity requirements with investments that have a high rate of return. Electronic controls and process innovations are also available that simultaneously increase the productivity of labor, energy, and capital. Waste heat recovery and advanced heat management that more efficiently converts and distributes energy from industrial processes represents a potential source of largely unexploited conservation. For example, a Washington State newspaper uses waste heat from its newspaper presses to warm its building, saving 500,000 kWh per year.[27]

Quebec should take the lead in accelerating the development of new technology to increase efficiency, and work with industries to promote adoption of the many technologies that are available. Funding a center for industrial energy efficiency

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[27]Bonneville Power Administration, 1990, supra at note 2.

would play a valuable role in developing new applications for emerging efficiency technology and transferring information on this technology to industry.

For example, in the pulp and paper industry advanced pulping processes, which integrate fermentation processes with conventional pulping processes, have great potential for energy savings.[28] More efficient distillation/separation processes, using membranes and supercritical fluid extraction could result in additional future savings.

2. Recycling

Quebec could play a more substantial role in the promotion and regulation of municipal solid waste recycling. Secondary materials manufacturing, using recycled goods as a raw material source, produce considerable savings in energy, as compared with primary materials manufacturing. This is particularly true for the aluminum, steel, glass, plastic, and some paper and paperboard industries. Quebec could require that municipalities meet specific recycling targets, expressed as a percentage of the wastestream and including types of recoverable materials. Mandatory procurement of recycled products by state agencies,

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[28]Oak Ridge National Laboratory, 1989, supra at note 25.

such as paper, and taxes on virgin materials can also serve to stimulate markets for recycled goods.

Aluminum

Most of the process-related energy expenditure associated with aluminum manufacturing is avoided with recycling. Producing aluminum from aluminum scrap saves 90-95 percent of the energy required to produce aluminum from alumina.[29] To promote aluminum recycling, Quebec could enact mandatory bottle (and can) deposit bills, such as those passed in Maine, Vermont, Massachusetts, and Connecticut.

Steel

Recycling steel scrap has been estimated to save roughly 75 percent of the energy in comparison with producing steel from iron ore, based on using 100% scrap in electric arc furnaces (EAFs). In practice, savings of about 45 percent are generally achieved.[30] Requiring the recovery and recycling of steel scrap from the wastestream and encouraging the construction of steel minimills (EAFs) through tax credits or accelerated depreciation allowances could increase rates of steel recycling.

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[29]Renard, M.L., 1982. A Review of Comparative Energy Use in Materials Potentially Recoverable from Municipal Solid Waste, prepared for U.S. Department of Energy (Washington DC: National Center for Resource Recovery, Inc., March).

[30]Renard, 1982, supra at note 29.

Glass

Energy savings associated with glass manufacturing is due primarily to reduced energy needed to melt the cullet (waste glass) versus melting the virgin raw materials.[31] Producing glass from 100 percent cullet saves about 30 percent of the energy used to produce glass from virgin materials.[32] Requiring municipalities to establish source separation and collection programs for glass could ensure a greater and more stable supply of cullet for glass recycling.

Plastic

Recycling thermoplastics can save 92-98 percent of the energy required to produce those plastics from virgin resins.[33] Major commodity thermoplastics that fall into this category include polyvinyl chloride (PVC), polyethylene terephthalate (PET), low-density polyethylene (LDPE), high-density polyethylene (HDPE), and polystyrene (PS). According to the U.S. Office of Technology Assessment, lack of collection of discarded thermoplastics is the primary barrier to increased recycling of

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[31]U.S. Congress, Office of Technology Assessment, Facing America's Trash: What Next for Municipal Solid Waste? OTA-O-424 (Washington DC: U.S. Government Printing Office, October 1989).

[32]Renard, 1982, supra at note 29.

[33]Argonne National Laboratory, Energy and Materials Use in the Production and Recycling of Consumer Goods Packaging, ANL/CNSV-TM-58, prepared for U.S. Department of Energy, (Argonne, IL: February 1981).

these products.[34] Quebec could help reduce this barrier by requiring mandatory source separation and collection of these products. In addition, taxing feedstocks used to produce virgin resins could create additional encouragement to the thermoplastics recycling industry.

Paper and Paperboard

Recycling of newsprint, printing paper, packaging paper, tissue paper, and corrugated board all save energy in comparison with manufacturing these products entirely from virgin fiber.[35] Major barriers to increasing recycling rates for these products are "lack of markets and higher levels of contaminants found in new supplies of [old newspapers]."[36] By increasing taxes on virgin fiber sources (timber) and reducing timber harvesting on provincial forests, Quebec could improve the financial competitiveness of recycled fiber, while reducing carbon emissions associated with forestry practices.[37] Research into

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[34]U.S. Congress, Office of Technology Assessment, 1989, supra at note 31.

[35]Gunn, T., and B. Hannon, 1983, "Energy conservation and Recycling in the Paper Industry," Resources and Energy, 5:243-260.

[36]U.S. Congress, Office of Technology Assessment, 1989, supra at note 31.

[37]See, for example, M. Harmon, W. Ferrell and J. Franklin, "Effects of Conversion of Old-Growth Forests to Young Forest," 247 Science 699-702 (Feb. 9, 1990).

improved deinking processes and less permanent and toxic dyes and inks could also facilitate paper recycling.

D. CONCLUSIONS

NRDC strongly urges Quebec to adopt least-cost planning criteria that ranks and selects energy resource options based on their full costs, including those characterized as environmental and cultural. Through implementation of least-cost investment and a concerted regulatory scheme that encourages secondary materials manufacturing and development and enforcement of efficiency codes for buildings and appliances, Quebec can meet its foreseeable energy needs. This approach, if implemented in Quebec, could stand as a global model of environmentally responsible energy planning, while protecting the unique ecological and cultural heritage that is integral to defining Quebec.

NRDC would like to extend an offer to assist Quebec in developing a least-cost planning framework. Our staff has had extensive involvement with electricity providers in both the U.S and Canada, developing demand-side management plans and constructing methodologies for equitably evaluating energy resource options based on both internal and external (i.e., environmental) costs.

ANNEXE C

TABLEAUX ANALYSANT LA PROFITABILITÉ
DES CONTRATS D'EXPORTATION DE
450 MW AVEC LE VERMONT
ET DE
1 000 MW AVEC NEW-YORK

This memorandum documents the Hydro-Quebec marginal cost figures used to consider and analyze the profitability of the VJO and NYPA contracts. A marginal cost of 48 mills per kWh (1989 dollars) escalating at 2% real through the 1990s and 1% real thereafter is used to approximate Hydro-Quebec's long-run incremental cost. While Hydro-Quebec has refused to provide direct documentation regarding its future costs (unlike other Canadian utilities including utilities with significant exports like Manitoba Hydro), the figures used here were benchmarked to a number of Hydro-Quebec estimates and statements.

1. The marginal cost in 1990 is approximately 20% above HQ's average 1989 rate of 40.6 mills/kWh, consistent with statements made in the Memoire presented to the Parliamentary Commission (p.14)

2. The levelized real marginal cost for the decade of the 1990s is 52.1 mills per kWh. This benchmarks well to an estimate of marginal cost based on the difference between the base and low scenarios in the Development Plan of 51.8 mills/kWh, developed as follows.

Medium Scenario	$61.8 billion	invested
Low Scenario	$38.0 billion	
Difference	$23.8 billion	
Less 20% for distribution	4.8 billion	
Net difference	$19.0 billion	
Deflated to constant dollars (1989)	$14.9 billion	
Multiplied by 6.34% real fixed charge rate	$944 million	
Divided by difference between mid and low scenarios in elec. requirements	19.3 TWh	
Cost difference per kWh	48.9 mills	
Plus line losses @ 6% for export	51.8 mills	

3. The difference between the medium and high scenarios, which is somewhat representative of the marginal costs of the 2000-2010 period in the base case (although it may be somewhat high due to greater investment in plant which is constructed to serve load in

the 2000-2005 period), is 77.7 mills/kWh calculated as follows:

High Scenario	$73.1 billion	invested
Medium Scenario	$61.8 billion	
Difference	$11.3 billion	
Less 20% for distribution	2.3 billion	
Net difference	$ 9.0 billion	
Deflated to constant dollars (1989)	$ 7.1 billion	
Multiplied by 6.34% real fixed charge rate	$447 million	
Divided by difference between mid and low scenarios in 1999 requirements	6.1 TWh	
Cost difference per kWh	73.3 mills	
Plus line losses @ 6% for export	77.7 mills	

As a result, it is suggested that marginal costs will continue to rise after the year 2000.

4. There is an 80% increase in marginal cost from 1990-2040, consistent with the 80% increase in cost of hydro starting with current projects (i.e., LaGrande Phase 2) to the highest cost economic hydro project identified by Hydro-Quebec (La Romaine) as stated in the Memoire (p. 16).

	Price 1989 $ $/MWh	TWh	Marginal Cost 1989 $ $/MWh	Revenue ($'000)	Marg Cost ($'000)	Profit from VJO ($'000)
0	44.67	.3	48.00	13401	14400	-999
1991	42.15	.7	48.96	29505	34272	-4767
1992	55.90	1	40.04	55080	40040	6040
1993	60.15	1.1	50.94	66165	56032	10133
1994	58.45	1.1	51.96	64295	57153	7142
1995	64.09	1.5	53.00	96135	79494	16641
1996	66.99	2.8	54.06	187572	151357	36215
1997	65.27	2.8	55.14	182756	154384	28372
1998	63.25	2.8	56.24	177100	157472	19628
1999	61.32	2.9	57.36	177828	166358	11470
2000	59.59	3	57.96	178770	173816	4954
2001	58.27	3	58.52	174810	175554	-744
2002	56.6	3	59.10	169800	177300	-7500
2003	55.07	3	59.69	165210	179082	-13872
2004	53.59	3	60.29	160770	180873	-20103
2005	52.18	3	60.89	156540	182682	-26142
2006	50.84	3	61.50	152520	184509	-31989
2007	49.56	3	62.12	148680	186354	-37674
2008	48.35	3	62.74	145050	188217	-43167
2009	47.2	3	63.37	141600	190100	-48500
2010	46.1	3	64.00	138300	192001	-53701
2011	45.06	3	64.64	135180	193921	-58741
2012	44.17	2.8	65.29	123676	182802	-59126
2013	44.17	2.2	65.94	97174	145067	-47893
2014	43.23	2.2	66.60	95106	146517	-51411
2015	42.27	1.9	67.26	80313	127803	-47490
2016	44.66	.3	67.94	13398	20381	-6983
2017	46.44	.1	68.62	4644	6862	-2218
2018	45.38	.1	69.30	4538	6930	-2392
2019	44.38	.1	70.00	4438	7000	-2562
2020	43.21	.1	70.70	4321	7070	-2749
NPV	6.0%	REAL				-80718

0	Price 1989 $	TWh	Marginal Cost 1989 $	Revenue ($'000)	Marg Cost ($'000)	Profit from NYPA
1990			48.00	0	0	0
1991			48.96	0	0	0
1992			49.94	0	0	0
1993			50.94	0	0	0
1994			51.96	0	0	0
1995	73.56	2.2	53.00	161832	116591	45241
1996	72.14	5.5	54.06	396770	297307	99463
1997	69.92	6.6	55.14	461472	363904	97568
1998	67.66	6.6	56.24	446556	371182	75374
1999	65.52	6.6	57.36	432432	378605	53827
2000	63.47	6.6	57.94	418902	382391	36511
2001	61.53	6.6	58.52	406098	386215	19883
2002	59.68	6.6	59.10	393888	390077	3811
2003	57.99	6.6	59.69	382734	393978	-11244
2004	56.38	6.6	60.29	372108	397918	-25810
2005	54.83	6.6	60.89	361878	401897	-40019
2006	53.36	6.6	61.50	352176	405916	-53740
2007	51.96	6.6	62.12	342936	409975	-67039
2008	50.63	6.6	62.74	334158	414075	-79917
2009	49.37	6.6	63.37	325842	418216	-92374
2010	48.17	6.6	64.00	317922	422398	-104476
2011	47.03	6.6	64.64	310398	426622	-116224
2012	45.94	6.6	65.29	303204	430888	-127684
2013	44.91	6.6	65.94	296406	436197	-139791
2014	43.93	6.6	66.60	289938	439549	-149611
2015	43.08	4.4	67.26	189552	295963	-106411
2016	41.83	1.1	67.94	46013	74731	-28718
2017			68.62			
2018			69.30			
2019			70.00			
2020			70.70			
NPV	6.0%	REAL				-60223